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NEW YORK, SATURDAY, APRIL 8, 1905.

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THE NATIONAL ELECTRICAL CODE.

As noted elsewhere in this issue, the American Institute of Electrical Engineers has sent a circular to its membership inviting recommendations concerning modification, addition or elimination of any requirement of the so-called National Electrical Code which their experience may have indicated as desirable. This information is desired prior to the annual national conference on the subject of underwriters' rules, and it is sincerely to be hoped that those who consider any of the present code requirements unjust will communicate their criticisms to the Institute representatives, whose duty it will be to demand a revision should these in their opinion be well founded. That there is a growing dissatisfaction on the score of the National Code cannot be denied, and it is desirable to determine at the earliest moment whether this is due merely to a natural antipathy to dictation from underwriters, to real injustice in rules, or to different interpretations of rules in different underwriters' districts. Should the second case be established, and no relief be accorded at the coming conference, the representatives of the various electrical bodies would be justified in recommending that the use of the names of their organizations in connection with the code be withdrawn; and even if the rules were held to be satisfactory in themselves, similar action might be justified should it be established that their usefulness is limited by unreasonable and arbitrary interpretation. Our columns are open to our readers who desire to point out in what respect the National Code is defective.

THE HARVARD-TECHNOLOGY ALLIANCE.

We have had occasion previously to speak of the projected union of interests between two of our greatest educational centers, but heretofore the information obtainable has been rather vague. Recently the reputed text of the protocol now under consideration has been published and has started renewed discussion. The whole question seems to be whether a permanent *modus vivendi* can be established without sooner or later involving organic union, at which the alumni of both institutions seems to shy. Many of the details of a possible alliance seem now to have been worked out very ingeniously, but there seems to be little agreement as to the bearing of the proposed terms upon this vital point. The general scheme is a working alliance between the institutions, with a practical merger between the Lawrence Scientific School and Technology. While actual competition between these institutions would very probably bring harm to neither in view of the great demand for technical education, still a wholesale duplication of plant would seem to involve a regrettable amount of wasted energy. But whether the proposed scheme would work permanently without an actual merger with Harvard is a question that would take a Philadelphia lawyer to determine. As we understand it, degrees would have to be granted by both institutions concurrently under the terms proposed, which would certainly be puzzling to a large body of future alumni. A man would wonder whether his affiliations really were with one or the other institution. This is only one of many similar difficult questions which arise as to future relations, and until the whole matter has been thoroughly threshed over it will be hard to say just what the proposed terms really imply. The whole question is under discussion among those most interested, and very possibly considerable modifications will have to be introduced before anything definite can be done. It may even be one of the cases where a very excellent end proves for practical reasons to be quite inaccessible. The broad principle of friendly co-operation between two great neighboring universities is certainly a sound one, but the case is not comparable with the com-

mercial forces that produce the union of two manufacturing plants. One can hardly conceive of destructive competition between the institutions here concerned.

GROUNDING THE SECONDARY.

We are glad to note that, after some years of discussion and after its necessity had been thoroughly demonstrated, the practice of grounding the secondary is on the increase and has recently been taken up by several large companies. To be sure, in at least one instance it required the goad of a fatal accident under especially distressing circumstances to start the good work along, but it is moving and sooner or later all the laggards will have to come into line. At the present time, in case of a fatal accident upon a secondary circuit, juries are rather apt to hit the company pretty hard on the ground of neglecting a well-known and simple precaution against accidents. One verdict of this sort is worth reams of discussion in waking up sluggish consciences. We note that the New England Insurance Exchange has recently put out a Code circular on the subject, which should prove valuable in keeping practice up to a sound standard. We have some doubt, however, as to the discretion of a clause limiting grounds to water pipes. It is at least conceivable that an excellent ground for the purpose could be obtained elsewhere, and it is a question whether municipal authorities may not sometimes object to thus grounding direct-current circuits, or even alternator-current circuits, on more or less fanciful notions of dangers from electrolysis. As, however, the only grounding of importance on the score of safety is that of the secondaries of transformers, objections of this sort can be quickly dissipated. There is no other way of averting the danger from the primary current breaking through upon the secondary—at least no way that may fairly be called reliable—and it is a precaution that should be taken whenever possible, which is practically always. In the old house-to-house distributions, grounding involved some considerable trouble and expense, but with the secondary mains now so much used it is a much simpler proposition. Merely as casualty insurance, if from no higher motive, it is well worth doing. It has taken a good many years of hard work to get around to workmanlike and sound methods in the practice of the smaller alternating plants, but the campaign of education has done its work, and safe methods are the rule where once they were the exception.

SOME METRIC CONSIDERATIONS.

A jolly row has recently been on between anti and pro-metric advocates in the columns of our esteemed contemporary, *Science*. The topic has been the time-wasted in mathematical teaching by reason of our weird and awful conglomeration of English units. Oddly enough, the actual figures given by both sides, barring the hair-splitting which too often accompanies debate on such a topic, seem to substantially agree in showing that the metric system would save about a year's teaching in the elements of arithmetic. This is certainly a conservative estimate in view of the judgment of some English educational authorities, and we think it would really fall within the facts. The actual time spent by unhappy children in juggling with the intricacies of English weights and measures is in the aggregate large, and the major part of it could be saved were the metric system in use—probably far more than 50 per cent. of it. But there is another side to the matter that should be also considered before putting the subject aside. Quite apart from the weights and measures, a very large amount of time is given in the schools to our dear old foe, common, or vulgar fractions. The entrance of the metric system should, and would, relegate vulgar fractions to an obscure and contracted corner of the background. Any one who looks over the portion of an arithmetic dealing with them is forcibly impressed with the utter uselessness of most of the material. The common fractions in actual common use are of the simplest character and their manipulation is easy, while all the serious computation of the world is done in decimals. These are to any people using decimal notation relatively very simple, and with a decimal system of weights and measures in use common fractions with their intricate manipulation would sink into unimportant place, to the great saving of time. It would not be far from correct, we fancy, to say that almost or quite another year's teaching in arithmetic would be saved in this way, simply by putting decimals into natural use. This does not seem to be a trivial gain in our days of hurried education, and is worth serious consideration.

FLUX DISTRIBUTION IN TRANSFORMERS.

That lack of uniformity of distribution of magnetic flux throughout the core of a stationary transformer may affect appreciably the losses in the iron due to the reversals of the magnetism, is not always taken into consideration. Even if it be true that the hysteresis loss varies as the 1.6 power of the magnetic density, and that the eddy-current loss is proportional accurately to the square of the density, it does not follow that the resultant losses in the core can be determined on the basis of the average value of flux density in any commercial design. To this fact can, doubtless, be attributed discrepancies between calculations based on the data of test samples and the results obtained in a completed transformer. If the permeance were constant throughout the whole mass of the iron, and it did not vary with change in magnetic density—an impossible condition when hysteresis is present—the flux in a commercial transformer would yet vary in distribution over any chosen cross-section of the core, due to the fact that the length of the path of the lines in the outer periphery would be greater than that of the lines at the inner periphery, thus resulting in a distribution of flux varying in intensity inversely with the lengths of the paths. With a distribution of this nature, the loss in any chosen part of the core would vary with the position of the part selected, and the total result would be quite different from that obtained with a mean density of the same value uniform throughout the magnetic material.

A discussion of the above consideration forms the subject of an article by Mr. A. Press, on page 682 of this issue. As pointed out by Mr. Press, the non-uniformity of flux due to the mechanical dimensions of the core contributes indirectly to a still further variation in the flux distribution, due to the fact that, up to a certain limit, with increase of density there is an actual decrease in specific reluctance of the magnetic material. For very high magnetic densities, any change in the specific reluctance of the core tends to equalize the flux distribution, and to render the losses uniform throughout the material. In predetermining the characteristics of a stationary transformer, account is not always taken of the change in permeability with variation of magnetic density in the core material, except as such change may affect the exciting current of transformers for low frequencies. It is apparent, however, that for absolute accuracy this factor cannot be ignored. No equation can be constructed which will represent the so-called *B-H* curve even for any single sample of iron, while different samples will show entirely distinct curves. It is possible, however, to make use of equations sufficiently exact to represent the variation in permeance for average commercial materials. Such an equation may take the form of the following, where μ is the permeability (ratio of the permeance of the material to that of air), and Bm is the maximum density in gausses: $\mu = 2{,}800 - 3.2\ (7.500 - Bm)^2\ 10^{-5}$, which equation gives a fair approximation to the permeability of average materials found in transformers, between the ranges of 0 and 15,000

gausses. It will be observed, as shown by Mr. Press, that when operating below a density of 7,000 gausses, the reluctance decreases quite rapidly with increase of flux. Since 60-cycle transformers are designed for densities seldom exceeding this value, it would seem that one should expect a considerable variation between calculations and observations of the losses by the methods in common use, if the correct hysteretic and eddy-current constants are employed.

Electrodeless Discharges.

In the ordinary electric arc or spark discharge the phenomena evidently depend in a marked degree upon the nature and properties of the electrodes, as well as upon the nature and properties of the intervening gas. Thus the electric arc in air is very different between carbon electrodes, as compared with iron electrodes, and so on. Consequently, the study of the phenomena of the arc in gases are masked and concealed by the complications dependent on the electrode conditions. It is for the above reasons that a study of the electrodeless discharge should be so fruitful in elucidating the real behavior of gases in this respect. It has long been known that an exhausted glass vessel, devoid of any inserted electrodes, might be excited into visible interior discharge by placing it in a rapidly varying electromagnetic field. In the Digest will be found an abstract of a paper in the March issue of the *Physical Review,* in which the theory of electrodeless discharge is discussed in an interesting manner by Bergen Davis. A glass globe containing the gas under test at a suitably low pressure was girdled by an induction coil in which oscillating currents of about a million cycles per second were set up. By varying the strength of the oscillating currents, the intensity of the electric field set up inside the globe was adjusted until the electrodeless discharge became visible. It was found that in the cases of air, helium, carbonic dioxide and hydrogen the minimum electric intensity that would set up the electrodeless discharge was about 20 volts per centimeter, or about 50 volts per inch. It depended to some extent upon the frequency. The lower the frequency the easier it was to excite the discharge and the lower the electric intensity which was needed.

It is almost impossible to examine the results without being impressed with the applicability of the ionic theory of matter, as well as the kinetic theory of gases. It seems that the atoms of the gas are careering hither and thither in every direction with a mean free path depending upon the pressure. At the pressures investigated, of 20 to 200 microns of mercury, the mean free path was in the neighborhood of one centimeter. Under these circumstances the velocities at collision are rarely sufficient to disrupt the ionic systems of the colliding atoms. That is, if each atom be imagined as a central positive sun with a large number of attendant negative satellites, the "collision" of two solar systems, while it may jolt the satellites up and set them swinging irregularly in their orbits, is not violent enough to tear satellites away from their systems. This means that the gas at this temperature and pressure is normally non-conducting, or electrically insulating. Here and there in the crowd of gaseous atoms there will be occasional encounters at exceptionally high velocities, for the velocities of the individual atomic systems are perpetually varying, and by the law of probability there must be always a few extremely high speeds as well as a few extremely low speeds, just as in any large community of, say, a million persons there must be always a few extremely tall men, or extremely heavy men, or extremely clever men, the great bulk of the community being, however, average in the respect considered. These few heavy encounters may disrupt satellites from their connection with the atoms to which they belong, and send the negatively electrified satellites wandering about alone. In time these odd disbanded mavericks may join themselves to some other atomic system, but for the time being they are free negative electrons, and no longer parts of neutral atomic systems.

If now an electric intensity comes into action upon the scene, the neutral atomic systems will not be disturbed, but the wandering negative electrons in existence for the time immediately obey the force like electrified pith-balls and move up the electric gradient in lines that would be coincident with the electric flux lines, were it not for zig-zags and deviations every moment by knocking against atomic systems that happen to be in the way. Between successive hits the negative electrons accumulate momentum under the electric driving force. If the force is great enough and the distance between encounters long enough, the electron will hit the next atom it meets such a blow as will probably knock off several satellites to join the throng of maverick electrons, just as a pellet thrown at a sphere of clay will either rebound harmlessly, or rebound in company with flying chips of clay from the sphere, according as the velocity of impact is low or high. According to the experiments detailed, if the electrons move through 5 volts between encounters, they can probably knock satellites off the atoms they strike. At the speed with which things happen in the atomic world, the critical electric intensity has to be at work only for a very small fraction of a second before the initial free negative electrons shall have swollen their army a million fold by the slaughter of innocent orbits and the knocking out of satellites. The presence of a large number of free negative electrons in the gas means that the gas has become conducting, and that the electrodeless discharge may occur within it.

The electric intensity which will set up electrodeless discharges in a given gas at an assigned temperature and pressure is, therefore, that intensity which will offer maverick satellites a free path of a certain number of volts between jolts in which to acquire enough electric momentum to smash a satellite chip off the next atom. In air, this critical voltage between strikes appears to be 5 volts, and it varies somewhat from gas to gas, according to the force with which satellites are held on, in their orbits, towards the positive central nucleus or sun. It is not to be supposed that matters of this kind occurring in the depths of physical laboratories are of no practical importance whatever. It is known that when the voltage at which electric power is transmitted over wires exceeds a certain value with respect to the diameter of the wire, the wire will produce a sort of brush discharge like a glow-worm, and that the power lost thereby may be relatively high with respect to that wasted by I^2R. Here the same phenomena are involved on a larger scale, because the air is at the ordinary atmospheric pressure instead of rarified in a vacuum tube, and the free path of an atom or an electron is therefore very much reduced. In order to give a chance wandering negative electron the five volts it needs to become a berserker in its neighborhood, the electric intensity at atmospheric pressure must be increased to about 37,000 volts per centimetre. The smaller the wire the greater will be the electric gradient of potential in its neighborhood, and the electric intensity. Air at ordinary pressure is known, in fact, to be electrically brittle at an intensity near 40,000 volts per centimeter, agreeing well with the experimental deductions above quoted. It is not likely that engineers will have difficulty in keeping the electric intensity around transmission wires below 40,000 volts per centimetre at ordinary atmospheric pressures. If the pressure of the air instead of being 760 millimetres of mercury were only a millimetre or two, the critical electric intensity would be so low that long-distance transmission through aerial wires would be impossible.

Convention of Ohio Independent Telephone Association.

The annual convention of the Ohio Independent Telephone Association was held at the Hartman Hotel, Columbus, Ohio, March 30. The meeting was called to order at 10 a.m. by President Beam, who presented Mayor Jeffrey. The Mayor welcomed the delegates on behalf of the city, and congratulated the telephone men on opening under such auspicious circumstances. The response to the Mayor's address was made by Frederick S. Dickson, of Cleveland, president of the United States Long-Distance Telephone Company.

At the afternoon session the following officers were elected: President, Frank L. Beam, of Columbus; secretary, E. E. Knox, of Portsmouth; treasurer and assistant secretary, Ralph Reamer, of Columbus. District vice-presidents were confirmed as follows: E. G. Miller, of Warren, district No. 1; W. F. Laubach, of Akron, district No. 2; J. B. Rhoades, of Zanesville, district No. 3; G. P. Thorp, of Wilmington, district No. 4; W. J. Thompson, of Hamilton, district No. 5; I. H. Thedieck, of Sydney, district No. 6; G. H. Metheany, of Lima, district No. 7; R. E. Hamblin, of Toledo, district No. 8; E. J. Grosscup, of Ashland, district No. 9.

Papers were read and topics discussed as follows: "Standardization of Equipment," by M. H. Clapp, O. F. French and B. H. Brooks; "Development of New Territory and Importance of Placing Properties on a Dividend-Paying Basis," by Dwight E. Sapp; "Operating Rules and a Standard Method of Accounting," by C. Y. McVey, S. E. Ward, George H. Metheany, C. E. Stinson and M. B. Overly; "Practical Operating and Maintenance of Exchanges," by C. E. Stinson; "How to Increase Long-Distance Business," by M. B. Overly; "Protection of Independent Interests by Manufacturers," by W. F. Laubach; "The Importance of the Association Appointing a Man to Give His Entire Time to Its Interests," by H. Folsom; "National Interstate Telephone Association," by J. B. Hoge.

It was stated that the Bell telephone interests were vigorously pushing their extensions wherever possible, occasionally absorbing an independent exchange, and that unless a thorough and complete organization was effected they would gradually disintegrate the independent alliance.

The convention authorized the employment of a State organizer at a salary not to exceed $3,600 per year and expenses to promote the interests of the association. The Constitution was also amended so as to empower the executive committee to make such other additional expenditures as were deemed necessary to the protection and advancement of the interests of the independent telephone holdings in Ohio. For the purpose of providing funds for this outlay, the association made itself liable to an assessment for emergency purposes of not to exceed 4 cents per telephone in active service. This is additional to the regular membership fee to constituent companies. There was no opposition to the provision for the emergency assessment, the discussion all being in enthusiastic approval of the step. A number of other amendments to the Constitution, less important, were also adopted.

The executive committee was also instructed to take up forthwith the complaints made from the convention floor that certain manufacturers of telephone supplies were furnishing equipment to exchanges that were to become competitors of independent exchanges. The sense of the convention was that lists of such offending companies should be prepared and furnished the constituent companies of the association with a view to their cutting off from them all orders for equipment or supplies in future.

The convention voted that the association should become a member of the National Interstate Telephone Association and named Frank L. Beam, of Columbus, a member of the advisory committee of that organization. Delegates and alternates were named to the annual convention to be held in Chicago June 20-21.

The special committee, named at last year's convention to report upon a plan for mutual insurance of telephone company property, reported that the only way in which such an insurance could be maintained would be by the organization of a company under the Ohio laws. The old New England plan for this company was suggested, each company insured to pay a specified rate per $1,000 of risk, the losses to be paid from the premiums collected, and any surplus to revert to the constituent companies annually in the way of dividends. No plan further than this suggestion was offered, and the convention, after brief consideration of the matter, referred it entirely to the executive committee for a later working out of a plan in detail.

Approximately 300 attended the convention. Of these 198 were accredited delegates, the remainder being made up largely of stockholders, who came to gather a better idea of the intentions and purposes of the organization and its plans for the future.

A banquet was given at the Hartman in the evening, at which Mr. F. S. Dickson, of Cleveland, acted as toastmaster. Toasts were responded to as follows: "Future of the Independent Telephone Movement," by Edward E. Kibler; "The Future," by Dwight E. Sapp; "Some Observations," by Henry A. Lanman; "The Stockholders and the Telephone," by H. M. Daugherty; "United Independents Versus Monopoly," by D. J. Cable; "The Past Decade," by J. B. Ware; "The Telephone as an Educator," by Dr. W. O. Thompson; "The Weather by Telephone," by local forecaster J. Warren Smith.

Proposed Rapid Transit Extensions in New York City.

The New York City Railway Company and the Interborough Rapid Transit Company last week applied to the New York Rapid Transit Commission for rights to build new underground rapid transit lines, the amount involved in the projected new work aggregating $200,000,000. These applications are now formally before the board, and it is said that other bidders will soon make proposals, among them the New York & Port Chester Railway, which plans to build a four-track, third-rail electric railway from New York to Port Chester, a distance of about 27 miles.

Neither the New York City Company nor the Interborough Company has applied for the right to build over the routes originally recommended to the Rapid Transit Commission. Each wants to build over a modified route that it thinks would best conserve its own interests.

The application of the New York City Railway Company is for two new trunk lines, each with four tracks, and a crosstown loop connecting the new Pennsylvania station with its proposed Third Avenue tunnel.

The Interborough Company's proposal, while in some instances it provides for lines to parallel those proposed by the New York City Railway Company, is in the main radically different from that company's plan. Routes are planned for both Manhattan and Brooklyn Boroughs. No new trunk lines are proposed for the former, however. All of the strictly new lines are to run across town. For Brooklyn there is planned a two-track line connecting with the loop under City Hall Park, Manhattan, and running thence under the East River to Fulton Street, Brooklyn, where it will connect with the tunnel now in course of construction, the latter to be of four tracks between Court Street and Atlantic Avenue. Other lines in Brooklyn are also provided for.

Since these proposals were made to the board the committee on plans and contracts of that body has reported on routes and plans deemed advisable for Manhattan, Bronx and Brooklyn Boroughs.

The committee recommended the following routes: No. 1, East Side route in First Avenue from the Borough of the Bronx, south to the Battery. No. 2, West Side route in Ninth and Columbus Avenues, from the Battery to West Two Hundred and Eleventh Street. No. 3, East Side route in Third Avenue, from the Borough of the Bronx to the Battery. No. 4, in Seventh Avenue, from Forty-second Street to Twenty-fifth Street, a four-track subway or a two-track subway. No. 5, a four-track subway in the Borough of Manhattan through Lexington Avenue from One Hundred and Twenty-seventh Street to Forty-second Street. No. 6, a crosstown two-track subway through Fifty-ninth Street, from Twelfth Avenue to the Blackwell's Island Bridge, then crossing the bridge to Queens. No. 7, a crosstown subway in Thirty-fourth Street, from Ninth Avenue to the Thirty-fourth Street Ferry. No. 8, crosstown subway from East Twenty-third Street Ferry on Twenty-third Street to West Twenty-third Street Ferry. No. 9, crosstown subway on Fourteenth Street, from Eleventh Avenue to a point between Avenues B and C, to connect with tunnel to Brooklyn. No. 10, from Fulton Street and Broadway, Brooklyn, through Broadway, over the Williamsburg Bridge to Delancy Street and Center Street to the proposed new terminal of the Brooklyn Bridge.

The Brooklyn Rapid Transit Company is the latest to appear as a prospective competitor in the building of the subway lines. It has requested the Rapid Transit Commissioners to furnish it with all maps prepared by the engineer of the commission affecting in any way the Brooklyn route.

Legislative Lighting Investigation in New York City.

The Legislative Committee to investigate the gas and electric companies of New York City devoted its sessions last week to the gas companies, and on Monday afternoon examined Mr. Henry M. Edwards, Auditor of the New York Edison Company. At adjournment the examination of Mr. Edwards was not concluded, and will be resumed on Thursday of this week.

Mr. Edwards testified that at the time the New York Gas, Electric Light, Heat and Power Company acquired the Edison Illuminatin Company, prior to being itself acquired by the New York Edison Company, the Illuminating Company had a $6,500,000 lien against its assets—taking the figures furnished by the company's books—of $12,307,296.95. This amount included $3,159,000 which was carried on the books for patents, and another amount of $375,000 representing the value of a plant belonging to the Harlem Lighting Company, which has remained as an asset on the books, though the plant was destroyed by fire in 1887 or 1888, and never replaced.

The total of the stock, bonds and other securities of the New York Edison Company, which in turn belong to the Consolidated Gas Company, was about $85,000,000. The New York Edison Company was formed by a merger of the New York Electric Light, Heat and Power Company and the Edison Electric Illuminating Company. Of the $85,000,000 mentioned, $64,500,000 represented the capital stock, mortgages and bonds of the power company. The book value of the assets of the power company at the time of the merger was $19,527,000.

The capital stock of the Illuminating Company was $9,200,000, and for each share of an estimated value of 104½ the Power Company paid $220 in 4 per cent. bonds. In addition it assumed the funded debt of the company. When the New York Edison Company took over the Power Company it took over, in addition to buying its $36,000,000 of stock, its funded debt of $4,067,883.30. The stocks and bonds of other companies merged into the Power Company, witness said, amounted in all to $13,643,300 at the time the $36,000,000 stock was issued. The company held some real estate worth $97,500, coupons of the Consolidated Telegraph and Subway Company worth $884,000, and of the Yonkers Electric Light Company worth $60,000. In all the book value of the property was $19,520,700.

The witness said that the New York Edison Company, which took over the liens against the properties included in the merger during the four years of its existence, had paid annually $1,785,034.36 on the funded debt. No dividends had been paid since the organization of the company in 1901, but a book surplus had been created which amounted to $7,909,651.20 at the end of 1904.

Referring to the item of $3,153,000 for patents, Mr. Hughes, counsel of the committee, asked if most of these had not expired. In reply Mr. Edwards said that some had expired, "but the name of Edison has not." Asked if the name of Edison had been capitalized, he replied that it was a valuable asset, and the company has the first call on Mr. Edison's inventive genius.

Award of John Fritz Gold Medal.

The first award of the John Fritz Medal, which was established by the professional associates and friends of Mr. John Fritz, of Bethlehem, Pa., on August 21, 1902, his eightieth birthday, to perpetuate the memory of his achievements in industrial progress, has been awarded to Lord Kelvin. This award was made by the following board, representing the several professional bodies named: American Society of Civil Engineers—Messrs. Robert Moore, Alfred Noble, Charles Warren Hunt and Charles Hermany. American Institute of Mining Engineers—Messrs. E. G. Spilsbury, James Douglas, Charles Kirchhoff and E. E. Olcott. American Society of Mechanical Engineers—Messrs. John E. Sweet, Robert W. Hunt, Samuel T. Wellman and James M. Dodge. American Institute of Electrical Engineers—Messrs. Carl Hering, Charles P. Steinmetz, Charles F. Scott and B. J. Arnold.

The medal is of gold, of value of about $100, and with it is presented a certificate of the award The title under which the award is made to Lord Kelvin is "Cable Telegraphy and other General Scientific Achievements."

Electrical Progress in West Avstralia.

The principal city of West Australia, Perth, has a population of only 40,000, yet during Christmas week the total number of lights equivalent to 8 cp in use at one time equaled 41,000, while most of the suburbs of the city have their own plants. Almost every town of 2,000 to 3,000 inhabitants has its electric lighting plants and is also well supplied with isolated power plants. So far the 220-volt system is used almost exclusively. Some of the mining towns 500 to 600 miles from Perth are lighted with small plants, though the price for current in these places usually runs from 25 to 35 cents per kw-hour. Those more fortunately situated with respect to water and fuel generally charge a flat rate of 20 cents per kw-hour.

The Electric Railway Company of Perth has at present a generating equipment of 1,500 kw, a 250-kw machine having lately been added, and a new sub-station of 500 kw is now in course of construction. The use of electricity is extending in the mines for power purposes, as the mining companies are settling to economical working and find that electricity is cheaper than other sources of power. The coal mines have recently introduced from America electric coal-cutting machines. Much of the larger work in electrical engineering in Western Australia has been done by Messrs. Splatt, Wall & Co. Mr. L. J. B. Wall, of this firm, is a member of the A. I. E. E.

Australian Patent Office.

Australia has now a Federal patent law and applications for patents hereafter will have to be filed and dealt with at the Central Patent Office, Melbourne. The law is to a great extent based upon the existing British system, with the notable addition that the official staff, before issuing a patent, must make an examination to ascertain whether the invention described has been previously patented or a patent applied for in any of the States composing the Federation. The most important feature is that an invention can now be protected throughout the whole of the Commonwealth for fourteen years by one patent at approximately one-third the cost which was formerly involved when six State patents had to be obtained (New South Wales, Victoria, South Australia, Western Australia, Tasmania and Queensland). The State patent offices are continued as offices of record and information where specifications of applications filed will, after their acceptance, be exbibited for public information. The act insures that patents previously obtained in the several States shall remain in full force with all the rights granted.

Commonwealth patents will be granted for fourteen years, and will be subject mainly to the usual conditions of British and Australian patents, with the exception that if one claim is found by a court to be invalid it shall not affect the validity of any other claim or of the patent so far as it relates to any valid claim. The Government of the Commonwealth may use any invention upon such terms as are agreed upon with the patentee, or in default of agreement, on terms settled by arbitration, or the Commonwealth or a State may, if thereto authorized by an act of Parliament, direct the patentee of the invention to assign his rights, the amount of compensation being decided by agreement or arbitration. An invention may be assigned before patenting, and the act provides that the communication of an invention to the minister for defense, and proceedings thereunder, shall not be deemed publication, or prejudice the validity of any patent thereafter granted. In the bill as originally introduced, there was a provision requiring the invention to be worked as a condition of its maintenance, but this clause was eliminated in passing through Parliament. The nearest approach to such a provision is a power conferred upon the commissioner or the court to order a license to be granted on fair terms to a person wishing to use a patented invention in respect of which "the reasonable requirements of the public may not have been satisfied." The ordinary powers of amendment and extension are provided for, and the act contains provisions under which the Commonwealth is enabled to become a party to the international convention, and it will probably do so. The procedure of application for patents by petition, accompanied by provisional or complete specifications, is very similar to that which has been in vogue, with the addition of examination as to novelty and a special power of the commissioner to note likely overlapping patents. We obtain the above information from a report by F. W. Goding, Consul at Newcastle, New South Wales.

Improvements in Arc Lighting.

A discussion which was full of points of practical value to all who are engaged either in selling or purchasing arc light illumination took place at a meeting of the Chicago branch of the American Institute of Electrical Engineers last week. The starting point of the discussion was a paper, accompanied by practical demonstrations, by Mr. George N. Eastman, covering the results of some 250 tests made to determine the most desirable sizes of carbons to be used with arc lamps of 5 and 3.5 amp. capacity. Mr. Eastman's recent tests have served to bring out more strongly than ever the conclusion that smaller carbons than are now common should be used in the 3.5 and 5-amp. arc lamps. These tests substantiate the position taken by Mr. Eastman in a paper read before the last convention of the Association of Edison Illuminating Companies, a report of which paper was given in these columns at that time.

Mr. Eastman favors 5/16-in. carbons for arc lamps of 5 amp. capacity and less. By the use of such carbons as compared to ½-in. carbons, the efficiency is increased in the 5-amp. lamp from 2.5 watts per mean spherical candle-power to 1.8 watts, while on the 3.5-amp. lamp such a reduction increases the efficiency from 3.4 watts with the ½-in. carbons to 2.2 watts with the 5/16-in. carbons. With the smaller carbons it is impossible for the crater to wander from one side of the lamp to the other, as it does in the ordinary enclosed arc, due to the fact that there is not room on the carbon tips for much wandering of the crater. This makes the light of the smaller carbons very much steadier. In the ordinary arc lamp the light at any given point varies between maximum and minimum values in the ratio of at least 1 to 3, because of the wandering of the arc between the blunt carbon ends. While part of the detrimental effect of the illumination caused by this wandering is eliminated by the use of an opal inner globe, and by the ordinary reflection from walls and ceilings, it is, nevertheless, one of the weak points of the ordinary arc lamps, especially where there is competition with various so-called gas-arc lamps using mantel burners, and about the only places where it is not severe at the present time are where gas and electric supply systems are owned by the same company.

A third great gain by the use of smaller carbons is in the color of the arc. The light is much nearer the sunlight in quality with the smaller than with the larger carbons, because with the latter the arc has a violet tint. The two principal points that have been urged against the use of carbons smaller than are now common are the increased cost of trimming, and the difficulty of securing good straight carbons of the smaller sizes, especially from American manufacturers. Mr. Eastman considers the matter merely from the standpoint of the cost to deliver a certain amount of illumination, and finds that, when the results in illumination are considered, one can easily afford to pay for the retrimming and cleaning of inner globes, at intervals of say 70 or 80 hours, and use the smaller carbons rather than use larger ones, running the lamps perhaps for 200 hours without retrimming or cleaning. The blackening of the inner globe after a run of 80 hours, together with the lower efficiency of the larger carbons, makes the cost of delivering light sufficiently more in the case of the long-burning, large-carbon arc than in the case of the small-carbon arc to counterbalance the extra cost of trimming the carbons.

The company with which Mr. Eastman is connected has heretofore made it a practice in many cases to clean inner globes once between trimmings, in which case with the smaller-carbon lamp there is an actual saving in labor, because the time of cleaning can be extended a little so that the cleaning and trimming can be done at the same time at intervals double the previous cleaning intervals. Of course, if it is a case where a central station company wishes simply to deliver a certain number of watts at the arc with a minimum expense for cleaning and trimming without regard to the illumination produced, the larger-carbon lamp should be used. It is the misconception of this fact on the part of many central station operators which probably has been responsible for the use of such large carbons as have been common. In fact, some manufacturers do not hesitate to say that they are aware of the advantages of smaller carbons, but that the demand is for the larger ones. Another obstacle in the way of the use of smaller carbons is the difficulty of securing ones which are straight and of good quality. As remarked by one of the participants in the discussion, with the increasing knowledge among central station men of the advantages of smaller carbons, a demand is likely soon to exist, and the manufacturer who is prepared to meet it promptly will be in a position to make some money. It is probable that if a demand existed it would be met by the manufacturers.

It is notable that all those participating in the discussion agreed with Mr. Eastman as to the improvements possible with small carbons and as to their general desirability. The higher efficiency obtained with small carbons has been a matter of general knowledge among arc lamp experts for a number of years, but with the open arc the rapid carbon consumption made small carbons out of the question, and when enclosed arcs were introduced open arc practice was followed, carbons having already been very generally standardized in the larger sizes. It was clearly demonstrated by Mr. Eastman that the difference in efficiency, steadiness and color, caused by the use of smaller carbons in the lamp using a given current, is not a matter whose determination depends upon a photometer. The difference appeals directly to the layman without the necessity for any laboratory tests.

Other ways of improving the illumination secured from arc lights were brought out in the discussion, Mr. W. D. Ryan taking up the matter of improvements in interior illumination, and Mr. V. R. Lansingh the possible improvements in street lighting. Mr. Ryan described a method whereby, with the use of very large reflecting surfaces of properly calculated form on the ceiling in the vicinity of an arc, a large percentage of the rays coming from the lamp above the horizontal were reflected back in useful directions, while at the same time the wandering of the arc which causes such an unequal distribution of light around the carbons was compensated for. This is done by the peculiar form of the reflecting surfaces, which if desired can be made so as to over compensate for the wandering of the arc to give the most light on the floor on that side of the carbons away from the arc. He also called attention to the change in the color of the light with variation in the position of the arc. In dry goods stores this change in color may take place while a customer is inspecting a piece of goods, and be a source of deception and annoyance. This is especially true in cases where the light comes largely from a single arc lamp.

Mr. V. R. Lansingh showed the results of recent attempts to correct the natural distribution of light around an arc lamp, so as to better adapt it to street lighting where it is desired that the greatest amount of light be thrown about 15° below the horizontal, instead of 40° as in the ordinary direct-current arc lamp. The tests described also included the determination of the best combination of clear and opal globes for outdoor lighting. It was found that by far the best results were obtained with an opal inner and a clear outer globe. As far as the ordinary types of globes were concerned, the illumination at great distances away from the arc, as in street lighting, was much better with this combination than with clear inner and outer globes. The best results were obtained with a new type of Holophane bell shade of rather peculiar design.

The remarks of both Mr. Lansingh and Mr. Ryan serve to emphasize the fact that there is still much room for improvement in common arc lighting practice in controlling the direction of the rays. In store lighting it is principally the upward rays which are likely to be wasted. Most attempts which have heretofore been made to reflect these upward rays have been very indifferently successful, because the size of reflector needed to accomplish best results in this line with an ordinary arc lamp is too large to be made a part of the lamp and attempts to do this with reflectors made as part of the lamp have amounted to little. Incidentally, it might be remarked that the majority of flat reflectors used over incandescent lamp clusters are far too small to accomplish the results which are expected to be obtained from them.

In street lighting, which formed the major subject of Mr. Lansingh's discussion, the point is not only to utilize the upward rays which would otherwise be wasted, but to take some of the surplus illumination from near the lamp and put it out at a distance where it is most needed, thus improving both the relative and the absolute illumination of the streets midway between lamps. How great an improvement can be made in this respect in street lighting is shown by the fact that Mr. Lansingh was able to obtain an increase of about 49 per cent. in illumination midway between street lamps simply by redirecting some of these otherwise useless rays. The problem resolves itself into one concerning the cost of cleaning and making renewals versus increased illumination secured, and there remains an opportunity for the central station man to make use of some individual calculations.

Michigan Independent Telephone Association.

The managers of 50 independent telephone companies met at Lansing, Mich., March 29, and formed an organization, which they expect to incorporate. The organization is along the lines of the National Telephone Association, and the Michigan organization intends to join the national body at the next meeting, which will be held in June. The association elected the following officers: President, E. B. Fisher, Grand Rapids; secretary, J. B. Ware, Grand Rapids; treasurer, William Robinson, Muskegon. Directors—W. O. Hunt, Adrian; N. F. Wing, Jackson; G. F. Root, Hart, and the president and secretary.

The State was divided into six districts, with a district president in each, who are vice-presidents of the State Association. These are R. B. McPherson, Howell; R. C. Smith, Homer; A. C. Himebaugh, Burr Oak; J. H. Fildew, St. Johns; C. W. Waverly, Kalkaska; H. A. Price, Saginaw.

Grounding Low-Potential Circuits.

The New England Insurance Exchange has issued a circular on this subject containing rules supplementary to Rule 13A of the National Electrical Code, amplifying and explaining the latter rule. The matter of grounded low-potential circuits has been actively taken up in Boston and its suburban territory, and central stations are grounding all secondary circuits as rapidly as circumstances will permit. Below we reprint the supplementary rules.

Before any ground is placed on the neutral of a three-wire or on either side of a two-wire installation, a test for grounds must be made, a voltmeter being used to determine the insulation of the system, and where more than one installation is supplied from the same transformer or bank of transformers a test must be made of all such installations before any ground connection is made.

Where the insulation resistance between any installation and ground is below that given by the table in rule 66 of the National Electrical Code, the party making the test shall notify the New England Insurance Exchange, and such installation must be examined and brought

GROUNDING LOW-POTENTIAL CIRCUITS.

to an insulation which will equal that called for by the table, before said installation or any other installation supplied by the same transformer or bank of transformers may be grounded.

When the ground connection or any part of the ground wire is inside of any building other than a central station or sub-station, then the following provisions must be complied with:

(*a*) The size of the ground wire to be not smaller than No. 4 B. & S. gauge, and to have an approved rubber insulating covering, National Electrical Code Standard for from 0 to 600 volts.

(*b*) The ground wire shall be connected to the system on the street or service side of the main cut-out and switch, the connection being made by a thoroughly made joint properly soldered and taped.

(*c*) The ground connection to be made only to water pipes. The connection must, if practicable, be made on the street side, i. e., the entrance side of all service cocks, meters, etc., and always as near as practicable to the point where the water pipe enters the building. The ground wire to be sweat into a lug attached to an approved clamp (see accompanying illustration) and the clamp firmly bolted to the water pipe. All rust and scale must be removed from the pipe where the clamp is attached.

(*d*) The ground wire to be kept as far as practicable on the outside of the building, to which it may be directly attached by cleats or straps or on porcelain knobs. Staples must never be used.

(*e*) Where it is necessary to run the ground wire through any part of a building other than the basement, it shall be run in approved moulding. In basements the ground wire shall be supported on porcelain or run in approved moulding.

(*f*) Wherever the ground wire passes through any wall of a building it shall be protected by an approved porcelain bushing.

(*g*) The ground wire should always be run in as straight a line and with as few bends as practicable, and must be properly protected where exposed to mechanical injury.

This protection can be secured by use of an approved moulding, and as a rule the ground wire on the outside of a building should be in moulding at all places where it is within 7 ft. from the ground.

Prizes for Protection of Workmen.

The Association of Italian Manufacturers has opened an international competition for prizes for the prevention of accidents in factories, in connection with the Milan Exhibition of 1906. The prizes are as follows:

a. A gold medal and 8,000 lire ($1,600) for a new appliance for preventing accidents arising from contacts between primary and secondary windings in alternating-current transformers. The appliance must fulfill the condition that no disturbance in the action of the transformer shall arise in case of atmospheric discharges or abnormal increase of potential.

b. A gold medal and 1,000 lire ($200) for a new type of hand crane or winch fitted with a simple and practical contrivance to prevent the possibility of the handles revolving during the descent of the load.

c. A gold medal and 500 lire ($100) for a safety appliance, simple, strong and reliable, to stop trucks automatically on an inclined plane should the hauling rope snap. The appliance must be adaptable to existing plant.

d. A gold medal for a system of absorption and collection of the dust produced in sorting and cutting rags by hand without giving rise to draughts detrimental to the health of the work people.

e. A gold medal for a system to carry off by suction the dust generated in carding flax, hemp and jute without detriment to the neighborhood.

f. A gold medal for a system to prevent the diffusion of dust in lime and cement works.

The conditions under which the competition will be carried out are as follows:

Applications to compete must be sent in not later than July 31, 1905, addressed to the president of the Association of Italian Manufacturers for the Prevention of Accidents in Factories, Foro Bonoparte, 61, Milan. All appliances entered for competition for the prizes *a*, *b* and *c* must be exhibited at the competitor's expense, in such dimensions and conditions as to allow of their being practically tested, at the Milan Exhibition of 1905, at such time as may be determined by the Exhibition Committee. No charge for space will be made to competitors who intend to exhibit their appliances in the space allotted to the Association; they must, however, in their applications to compete state the exact area they require. The acceptance of all applications to compete is reserved to the president of the Association. Competitors who elect to exhbit in other sections of the exhbition must attach a notice to their appliances stating that they form part of the competition founded by the Association. They must forward to the Association not later than January 1, 1906, a properly executed detailed drawing of their appliances, which the Association will exhibit in their own section.

Competitors for the prizes *d*, *e* and *f* must have their appliances at work in works in Italy; they must also forward to the Association, to be placed in their exhibit, a detailed drawing, a small model and a full description of their appliances. All appliances presented for competition are the property of competitors; the Association will, however, retain the drawings, models and descriptions. All rights connected with the appliances are the exclusive property of their owners, who must, however, take all necessary steps to guarantee their rights. The Association reserves the right to publish at the close of the exhbition a description and drawings of all the appliances. A committee, appointed by the Council of the Association, will examine all appliances presented for competition. The appliances approved of in principle will be subjected to tests after which they will be classified according to their merits. The Council of the Association will award the prizes in accordance with the report of the Committee; no appeal against their decisions will be entertained.

Chicago Railway Municipalization.

The election of Judge Dunne as Mayor of Chicago on a platform of immediate municipalization of the railways of that city gives additional interest to the recent action of the Local Transportation Committee of the City Council, directing Mayor Harrison to adverise for bids for the construction of a municipal street railway on streets where the franchises owned by the Chicago Passenger Railway Company are held to have expired. Lines on these streets are at present operated by the Chicago Union Traction Company. Proposals will be on two alternatives, namely, city ownership and city operation, and city ownership and company operation. It is further announced that Mr. Bion J. Arnold has been engaged to draw up plans for the system proposed, to be completed by June 1. The bids will be opened July 1, 1905.

The Telephone in Newspaper Reporting.

The New York *Tribune* a few days ago printed an interesting article on the use of the telephone in newspaper reporting. "If anything happens, jump to the nearest telephone," should be the first thought and duty of the reporter.

On some of the New York evening papers, the article states, there are reporters of the regular staff who do not see the office for weeks, or even months, at a time. Their salaries are sent to them by messengers. They receive their assignments by telephone, and after getting their stories they telephone the facts to the office. If the story is a particular "rush" affair the reporter dictates into the receiver to the man in the office, who raps it off on a typewriter. Such a reporter's telephone tolls may mount as high as forty or fifty "calls" a day. Some of the papers have a rule that every reporter must call up the office once every half hour, whether there is any news to be given or not. Thus a city editor may keep constantly in touch with fifteen or twenty men "on assignments," and is able to take a man from a comparatively unimportant assignment and send him "on the jump" to the scene of a "big story."

The telephone is furthermore invaluable in a newspaper office in obtaining long distance news in a hurry. It often beats the telegraph, as it did in many cases last November, when the long-distance lines of the Bell system were used for sending news of the Presidential election over the country. Managers of the companies made elaborate arrangements to transmit the news quickly both to the papers and to other telephone users. New York City was the receiving headquarters, with Chicago a Middle West station. Then headquarters were maintained in each State. Messages from rural districts were sent to these State centres, and they were later sent to New York. From New York they were scattered over the country, consuming about seven minutes in transmission. As the Bell lines reach nearly thirty thousand communities in the United States, this telephone election service brought immediate news from places which otherwise would not have been heard from until the next day, and perhaps not then.

Indiana Electrical Contractors Meet.

The fourth semi-annual meeting of the Indiana Electrical Contractors' Association was held in the Claypool Hotel, Indianapolis, March 29. There were about thirty-five members present from all parts of the State. Both morning and afternoon sessions were presided over by the president, C. C. Hatfield, of Kokomo. The programme was somewhat informal, but spirited discussions were aroused by the method adopted by President Hatfield in opening the discussion and propounding questions. The Insurance Code for electrical wiring and the stringent provisions named in city ordinances regulating wiring were discussed freely. Other subjects of interest to the business were also discussed.

At the close of the afternoon session, which was full of interest, an informal dinner was given at the Claypool, and then the electrical men visited the theatre, after which they attended a midnight banquet at the Columbia Club.

The Indiana Association is growing in interest and number of members, and is bringing about a wholesome condition in electric wiring. The annual meeting will be held November 1.

CURRENT NEWS AND NOTES.

TELEPHONE LINES ON SINGLE-PHASE RAILWAYS.—It is reported that on the Indianapolis-Rushville road, where telephone wires are on the same pole line as the single-phase trolley, the telephonic service is little, if any, affected with respect to clearness of talking. This report should tend to allay the fears of those who anticipated trouble from the proximity of the overhead single-phase wire to, and the distance of separation of the grounded return wire from, the telephone circuits.

THE DENVER N. E. L. A. CONVENTION.—Mr. La Rue Vredenburgh, who so ably handled the subject of advertising in his report presented at the Boston convention of the National Electric Light Association, will this year make a report on "The Commercial Side of Sign and Decorative Lighting," which will be presented at the Denver-Colorado Springs convention, to be held June 6-11. This is a subject of great interest to all members of the association and Mr. Vredenburgh's skill and experience will enable him to handle it in a most satisfactory and interesting manner.

DELIVERY OF TELEGRAMS ON TRAINS.—It is stated that the Pennsylvania Railroad Company has issued orders requiring its passenger trainmen to co-operate with employees of the Postal and Western Union Telegraph Companies in delivering telegrams addressed to passengers. The messenger, if the train schedule permits, will canvass the train carefully. If he cannot locate the passenger the message will be turned over to the conductor, who will make additional efforts to deliver the message. If not found, the telegram is to be returned to the sender, who will be advised of the non-delivery.

ONTARIO POWER COMPANY'S PLANT.—The first of the Stoney sluices at the headworks of the Ontario Power Company, Niagara Falls, has been set in place. The sluice or gate is 18 ft. square and operates under a head of 35 ft. between water level and sill. The gate head does not extend above the water level, but closes the entrance to an 18-ft. conduit, the top of which is 17 ft. below water level. The operating mechanism, which extends about 15 ft. above water level, will be covered with a house of a design to harmonize with the surroundings in Queen Victoria Park, within the limits of which the headworks are located.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—The twenty-fourth annual meeting of the Association of Railway Telegraph Superintendents will be held at the Read House, Chattanooga, Tenn., May 17 and 18, 1905. The Committee of Arrangements have prepared an excellent programme, including trips up Lookout Mountain and to the new Army Post and Battlefield of Chickamauga. Transportation should be arranged for in the usual way through railway official requests. Any members of the association and their families, not otherwise provided for, may apply to G. L. Lang, superintendent of telegraph C., N. O. & T. P. Ry., for transportation over that line. Mr. P. W. Drew, Colby & Abbott Building, Milwaukee, Wis., is secretary of the association.

STANDARD ELECTRICAL RULES.—The American Institute of Electrical Engineers, in announcing a meeting of the National Conference on Standard Electrical Rules, to be held at 10 o'clock a.m., Friday, April 21, 1905, at No. 55 Kilby Street, Boston, to which the Institute will send an official delegate and also be represented by its Committee on National Electrical Code, requests suggestions from members as to changes in the National Code. Recommendations are invited concerning modification, addition to, elimination of any rule or requirement which may be shown to be necessary as a result of experience in the practical operation of the Code or owing to the progress in the state of the art. If no criticisms are received by the chairman of the Code Committee prior to April 14, it will be assumed that no special action amending the Code is called for by the Institute membership. Communications, preferably typewritten, should be sent to the chairman of the Code Committee, Dr. A. E. Kennelly, Harvard University, Cambridge, Mass., not later than April 14, 1905, so that they may be considered by the committee in advance of the meeting of the National Conference.

WESTERN SOCIETY OF ENGINEERS.—At the next meeting of the electrical section of the Western Society of Engineers, to be held in Chicago, April 14, Mr. Charles H. Smoot will present a paper on "A Simple Electrical Method of Determining Flux Distribution and Magnetic Reluctance in Odd-Shaped Air-Gaps."

SURGICAL OPERATION ON LORD KELVIN.—A special dispatch from London, March 30, brought the intelligence that Lord Kelvin underwent a serious operation March 29. He is reported to be progressing as well as could be expected. The distinguished patient is 81 years of age. Later accounts state that Lord Kelvin is progressing favorably toward recovery.

WANT A PRESIDENTIAL BOYCOTT.—It is reported that the Order of Railway Telegraphers has notified all of its local organizations to join in a protest against the proposed journey of President Roosevelt over the Missouri, Kansas & Texas Railroad during his visit to the South in April for the reason that the union telegraph operators on that road are out on strike.

GENERAL ELECTRIC DINNER.—The annual dinner given by the General Electric Company to its central station representatives was held in Boston March 31. Mr. C. R. Davis, manager of the Boston office, presided. There were present 180 gentlemen, including Prof. A. E. Kennelly, Prof. Elihu Thomson, Prof. E. F. Miller and W. C. Fish, manager of the Lynn works.

MAGNETIC CLUB DINNER.—The spring meeting and dinner of the Magnetic Club will be held at the Hotel Astor, Broadway and Forty-fourth Street, New York, Thursday, April 13. It is expected that the dinner will be attended by several prominent electrical and telegraph men as guests. Col. A. B. Chandler, of the Postal Telegraph-Cable Company, is the president of the club this year.

TELEPHONE DESPATCHING ON THE PENNSYLVANIA.—According to a dispatch from Philadelphia the telegraphic department of the Pennsylvania Railroad Company has decided to abandon the telegraph as a means of handling trains at several points in Pennsylvania, on the Central division of the Philadelphia, Baltimore & Washington branch of its system. The telephone will replace it.

CARNEGIE GIFT FOR NORWICH UNIVERSITY.—At the dinner of the New York Association of Norwich University on the night of March 30 it was announced that Mr. Andrew Carnegie had made a gift of $50,000 to the university for a library building and the equipment of an electrical department. President Granville M. Dodge said that on a recent visit to Mr. Carnegie he had told him of the needs of the university.

FRENCH CABLE COMPANY IN VENEZUELA.—A dispatch from Caracas, the capital of Venezuela, states that President Arnal, of the Supreme Court, March 31 announced the decision in the Government's case against the French Cable Company. He decided that the contract had been forfeited; that the terms of the engagement had not been fulfilled, but decided against the Venezuelan Government in an action for damages resulting from the French Company's acts. President Castro's complaint against the French Cable Company was that it had not fully complied with the terms of the concession, and had, moreover, given aid to the insurgents. It is stated that the French Cable Company will probably take an appeal to the full court.

THE TANTALUM LAMP.—We are informed that the entire daily output in Germany of the tantalum lamp, which will shortly reach an average of about 5,000 a day, is sold as fast as produced, and this without advertising the lamp for sale. Of the lamps sent out during the past two months, it is stated that less than 2 per cent. have been returned as defective, which is reasonably considered a very satisfactory result in the case of such a new and radical development. A good many experiments have been made to determine if the life of the tantalum lamp is injuriously affected by turning current off and on frequently. Results of these tests are reported as very satisfactory, and it is stated that the life of the filament is not affected, even though the current be interrupted as often as once a minute.

EUROPEAN LECTURERS AT COLUMBIA.—Prof. H. A. Lorentz, professor of physics in the University of Leyden, and Prof. W. V. Bjerkness, professor of mechanics and mathematical physics in the University of Stockholm, have accepted appointments to lecture at Columbia University. Prof. Bjerkness will lecture in November and December of the present year, and Prof. Lorentz in April and May of next year. In a newspaper interview Prof. Pupin said that Prof. Lorentz is one of the most distinguished mathematical physicists in Europe and has contributed more than any other man to the development of the Clerk-Maxwell electromagnetic theory. He predicted as a result of the modern electromagnetic theory that an incandescent gas when placed in a strong mechanical field would change its spectrum, an inference from which is that the ultimate parts of matter are electrified and that the light emitted by an incandescent body is produced by these minute electrified particles. The Nobel prize of $40,000 was awarded conjointly to Lorentz and Zeeman in recognition of their work in this field. Prof. Bjerkness will lecture on the field of force.

SUMMER SCHOOL FOR ARTISANS.—The fifth annual session of the Summer School for Artisans, held under the direction of the College of Engineering of the University of Wisconsin, will begin on June 26 and continue for six weeks. Courses of study are offered in the following subjects: (1) engines and boilers, (2) applied electricity, (3) mechanical drawing and machine design, (4) materials of construction, fuels and lubricants, and (5) shop work. The lectures and laboratory courses in applied electricity cover the theory of direct and alternating-current dynamos and motors, the operation and method of testing electrical machinery, batteries, transformers and other apparatus, the photometry of electric lamps and the calibration of instruments. The requirements for admission do not extend beyond a working knowledge of English and arithmetic, but the policy is to allow a large amount of individual work, so that the student may take advantage of all the preparation he has obtained. Many young men who are unable to take a regular engineering course for financial or other reasons may obtain from the summer school much that is of benefit to them in their work. Correspondence students have found the school of value in giving an opportunity for laboratory practice along lines in which they have had theoretical instruction.

MARCONI TRANSATLANTIC WIRELESS.—Mr. Marconi, who is now in New York, intends to proceed to Glace Bay, N. S., in a few days to supervise the installation there of transatlantic wireless telegraph apparatus. He says five weeks will be consumed in the completion of the Glace Bay station, and the experiments which are expected to result in the establishment of transoceanic communication. "The station has been removed seven miles inland from its former location," said he. "The object of this removal is to secure a location which shall be safe from bombardment and destruction by the enemy's fleet in event of war. Two hundred thousand dollars will be expended in the erection and equipment of the new station, which will differ materially in form of structure from the former station. Concentric rings of poles have been erected whereby the superficial area of the wires is greatly increased, making it possible to exert much greater power in the sending of messages. I am not able to state definitely when the system will be in practical working order, but it will be within six months, I believe. The new sending and receiving apparatus by which the speed of wireless will be increased from 24 to 100 words a minute will not be tested on the transatlantic circuit until it is working satisfactorily with the slower instruments. Upon my return voyage to England a test of the more rapid apparatus will be made and we have every reason to expect complete success. The *Campania* was in continuous wireless communication throughout the voyage. News from both shores was received daily. When 1,560 miles from Liverpool a message was received stating that the English Government had decided to establish communication between six lightships by wireless and that if the service proved satisfactory all lighthouses and lightships on the British coast will be similarly equipped. The *Campania* was also in communication with the new Allan Line turbine steamship *Victorian.*" Mr. Marconi further stated: "When the station at Pisa is completed, which will be within two years, we will be able to send wireless messages around the world, via Australia."

N. E. L. A. CONVENTION.—Mr. Frank Frueauff, of Denver, when in New York last week, stated that the railroad people have been making an extensive canvass among possible delegates for the Denver-Colorado Springs Convention of the National Electric Light Association. They report their belief that there will be an attendance of at least 3500. This may be a little optimistic, but there is no question that the meeting will break all previous records in point of attendance as well as in point of general attractiveness.

VARIABLE-SPEED TRANSFORMER.—The use of a boosting transformer, the primary of which is supplied with a variable voltage and is located in inductive relation to leads extending from a main transformer, is involved in a patent granted on March 28 to Mr. Walter S. Moody. The e.m.f. of the boosting transformer may either add to or counteract a portion of the voltage of the main transformer, thus allowing a considerable range of operation. This arrangement is of advantage for use with very low-potential, high-current capacity transformers. The inventor describes such a transformer, the low-potential winding of which consists of a few turns of copper tubes through which there is maintained a circulation of water for cooling purposes.

SYNTONIC WIRELESS TELEGRAPHY.—A patent issued March 28 to G. Marconi relates to a form of wireless telegraphy receiver which will permit of tuning, and will minimize the effects of thunderstorms. Between the grounded detector and the aerial there are connected in series a condenser and a choke coil, the inductance of which latter can be varied at will. A connection is made to earth from the choke coil at a point so chosen that the natural period of the aerial and one section of the coil is the same as that of the condenser and the other section, and equal to the period of the particular electric waves to which this receiver station is to respond. It is stated that by this means a sharp selectivity of signals is obtained, and the troublesome effects of atmospheric electricity are largely eliminated.

IOWA STREET AND INTERURBAN ASSOCIATION.—The second annual convention of this association will be held at Dubuque, Ia., April 20 and 21. Among the papers that will be read are the following: "Handling Freight by Interurban and Interchange of Business with Steam Railroads," by Mr. H. H. Folk, Des Moines; "Accounting as an Aid to the Operating Department," by Mr. R. A. Leussler, Council Bluffs; "Car Shop Methods," by Mr. John D. Fish, Davenport; "Rural Railways," by Mr. F. McDonald, Waterloo; "The Adoption of Gasoline Motors for Street and Interurban Service." The Association will attend in a body an afternoon session of the Iowa Electrical Association to hear a paper by Mr. W. E. Boileau on "Steam Turbines." The secretary of the Association is Mr. L. D. Mathes, Dubuque.

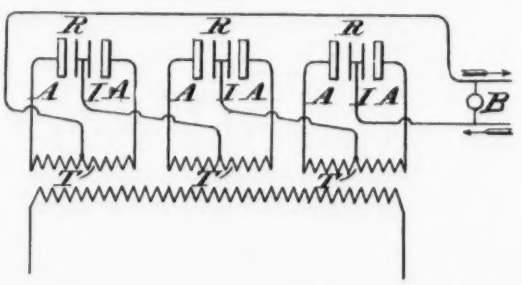
COMMUTATOR FOR ALTERNATING-CURRENT MOTORS.—In order to prevent the sparking at commutators due to the transformer effect of the coil under the brush in alternating-current motors, it has been proposed to provide the armature with two windings and to connect these alternately with the segments of a common commutator. If with this arrangement the brushes are made narrower than any one of the segments, direct short-circuiting of an individual coil may be avoided, but two armature circuits of different e.m.f's are connected in parallel by the brushes, so that here also there is a closed circuit in which are set up currents corresponding with the difference of e.m.f. Max Deri, in a patent issued March 28, describes a method of using two armature windings in such a way that there can be no short-circuiting between them. Each winding is provided with a separate commutator, and with separate brushes and brush connections, so that the two circuits of the armature in their whole extent are separated from each other. The insulating strips between the segments of the commutator are made broader than the brushes, so that each armature circuit is entirely interrupted as often as the brushes pass between two segments. The positions of the brushes are such that the moment of interruption at the one commutator is coincident with the complete contact of the brushes at the other, and there is always at least one circuit of the armature closed. The two windings should lie in the same slots, so that the inductive effect will be the same as though the current were not interrupted in each individual circuit.

FRANCHISE TAX ASSESSMENTS.—The State Board of Tax Commissioners has announced the franchise tax assessments levied upon New York City corporations for the year 1905. The total valuations for 1904 was $251,158,450, and the valuations for 1905 are $302,193,550, showing an increase of over $50,000,000. The valuation of the New York Edison Company is raised from $11,515,000 to $12,660,000; Manhattan Railway Company, from $46,700,000 to $55,750,000; Brooklyn Rapid Transit system from $25,552,000 to $29,560,000; New York Street Railway system, from $74,860,000 to $79,233,000; Edison Electric Illuminating Company, of Brooklyn, from $3,644,000 to $4,900,000; Empire City Subway Company, from $4,300,000 to $4,622,000; New York Telephone Company, from $5,015,000 to $6,610,000; New York & New Jersey Telephone Company, from $1,320,000 to $1,700,000; Consolidated Telegraph & Electrical Subway Company, from $4,483,000 to $4,550,000.

WIRELESS TELEGRAPHY IN CANADA.—The Marconi Wireless Telegraph Compay in London has stated that in view of the commercial demand between England and America a new station with the latest improvements had been nearly completed in Canada. With a reduced rate to 12 cents per word the directors thought two wireless stations would be fully employed during the year. Four stations had been equipped on the St. Lawrence, and a new contract had been entered into with the Canadian company, representing the extension of the organization of the wireless telegraph stations already established by the order of the Canadian Government. Five stations also had been equipped at fishing centers along the Labrador coast. When other stations contemplated in Canada had been erected there would be chain of stations, and they will afford the Newfoundland Government direct wireless communication between the Labrador coast and Canada. As noted elsewhere, Mr. Marconi will go to Glace Bay in a few days.

NEW YORK ELECTRICAL SHOW.—Announcement has been made of an electrical show, to be held at Madison Square Garden, December 12 to 23, 1905. The construction of dynamos and motors of various types, the progress in telephony and telegraphy, motor speed control, and its use in machine tool driving, and the various types of power transmission engineering, will be illustrated. Exhibit space will be sold and selling privileges for electrical novelties and other specialties will be disposed of. Direct current at 115 volts and alternating-current, two-phase, 60-cycle at 104 volts, will be available. Gas can be secured and steam will be available to a limited extent. It is the intention to make the exposition exclusively an electrical and mechanical exhibit, and the management reserves the right to decline and prohibit any exhibit not approved. Information concerning any matter pertaining to the exhibition may be obtained from Prof. G. F. Sever, director of exhibits, at 26 Cortlandt Street, New York City. Application for special privileges, such as advertising souvenirs, etc., must be submitted to Prof. Sever, not later than December 1, 1905.

ALTERNATING-CURRENT RECTIFIER.—A patent granted March 21 to Mr. Charles F. Burgess upon an application filed August 15, 1903, relates to the use of several electrolytic or vapor converters in series to obtain a high value of e.m.f. The connections are shown in the accompanying illustration, where *R* is a rectifier containing two aluminum electrodes, *A A*, and an iron electrode, *I*. The alternating pressure applied to the two extreme terminals will allow little or no current to flow, but by connecting these asymmetric conductors to the outside terminals of an induction having an intermediate terminal a rectified current may be obtained between such intermediate terminal and the intermediate terminal of the asymmetric conductors.



Largest Electric Water Power in Maine.

DEER RIPS, on the Androscoggin River, about three miles above Lewiston, Me., is the site of the largest hydro-electric development in that State. At this point the bedrock of the river formed a natural fall between high stone banks on either side, and a dam has increased this fall to fully 30 ft. From one end of this dam a canal has been excavated through the solid rock of the right bank of the river to a power house at the water's edge, about 700 ft. down stream. (See Fig. 1.) Here the water drops through horizontal turbine wheels connected to electric generators that are designed for an ultimate total capacity of at least 10,000 hp.

For this development the entire flow of the Androscoggin River at Deer Rips is available. Just what this discharge is, the figures now at hand do not indicate, but at Rumford Falls, about 47 miles up stream, the records for the year 1902 show a minimum daily discharge of 1,580 second-feet in December, and 4,948 second-feet in April. For February, the month of lowest mean discharge, the figures were 2,053 second-feet, and for March, the month of greatest mean discharge, the rate was 8,718 second-feet. March also led in maximum daily discharge with 18,486 second-feet. At Rumford Falls the drainage area of the Androscoggin River is 2,220 square miles, while at Lewiston the drainage area up stream is 3,120 miles, an increase of about 50 per cent.

With the minimum discharge of 1,580 second-feet at Rumford Falls, in December, 1902, and an effective head of 30 feet, the discharge of the Androscoggin River would have developed 5,343 gross hp. With a combined efficiency of 70 per cent. for water wheels and electric generators, this gross development would yield 3,740 hp 24 hours per day for electric transmission.

If it be assumed that the increase of 50 per cent. in drainage area at Deer Rips above that at Rumford Falls carries with it a like increase of river discharge, it follows that the minimum electric output during a 24-hour day at Deer Rips, in 1902, might have been 5,610 hp. As power for most manufacturing operations is used hardly more than 10 hours daily, and as there is storage capacity behind the dam at Deer Rips for the greater part of the flow of the Androscoggin during 24 hours, it follows that an electric station there might have delivered more than 10,000 hp during usual working hours in the dryest month of 1902. On most days of the year the electric output might have been much greater than that just named, for no month showed a mean daily discharge of less than 2,053 cu. ft. per second, and nine months had mean daily discharges of 2,551 to 8,440 cu. ft. per second, at Rumford Falls. These facts were thought ample justification for the erection of a hydro-electric plant of 10,000 hp capacity at Deer Rips.

On April 16, 1902, work was begun on the power development at Deer Rips, and on November 16, 1904, two years and seven months later, the new generating station there went into regular operation. All of the work at the dam was done by the day under the supervision of the owners of the property and their engineers, and it is of a most substantial character. Before work was begun it was decided that the dam across the Androscoggin, the forebay walls at the down-stream end of the canal and the foundations of the power house should all be of concrete. Along nearly all of its 700 ft. of length it was necessary to excavate to a depth of 20 to 30 ft. of solid rock, and more than 40,000 cu. yards of stone were taken from the canal bed and the site of the power house. This stone was

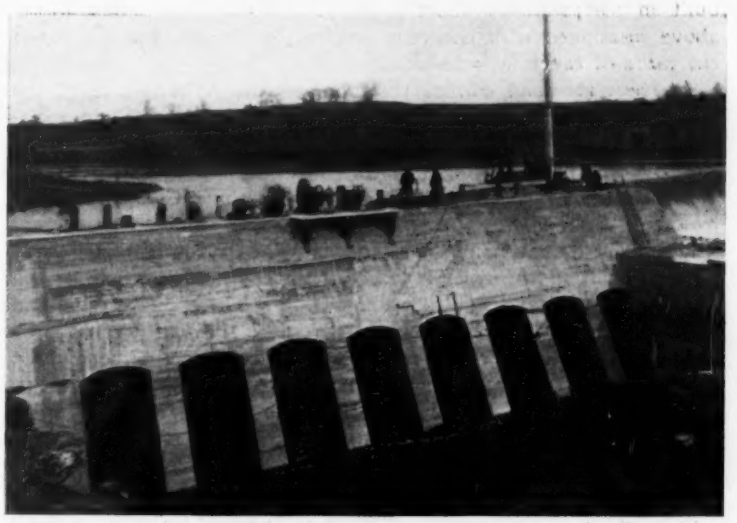


FIG. 2.—HEAD GATES TO CANAL, DEER RIPS.

suitable for making concrete and the plan of operation was to convey the stone excavated from the canal bed to a crusher located at the canal end of the dam, and there to transform it into concrete. The concrete was then conveyed as fast as made to forms built of timber on the river bed, and there left to harden into the substance of the dam. In the manufacture of this concrete fully 40,000 casks of Atlas Portland cement were consumed. For the poorest of the concrete 1½ casks of this cement were used per cu. yard, and on a part of the work the mixture was 2¼ casks of cement per cu. yard of concrete.

Nothing short of bedrock was accepted for any part of the foundation of the dam, and its abutments were carried deep into the natural ledge at either bank. In height the dam varies much owing to the very irregular nature of the rock that forms the river bed. At one point in the overflow section of the dam its height above bedrock is only 21.5 ft., and at another point nearer shore the height of crest above bedrock is 40 ft. In location, the dam sets a little back of the natural fall in the bed of the river, and it is made up of three straight stretches that join each other and the river banks at different angles. The center stretch of the dam is approximately at right angles to the thread of the stream, and it forms part of an overflow section, or spillway, with a length of 736 ft. The retaining wall sections of the dam bring its total length up to 1,013 ft.

At the top, the dam has a width of 9 ft., and at the bottom the

FIG. 1.—CANAL, FOREBAY AND POWER HOUSE AT DEER RIPS.

thickness varies with the height, being 28 ft. where the height is 28 ft., and 40 ft. where the height is 40 ft. At one point in the spillway sections of the dam, about 25 ft. below its crest, four lines of tile drain pipes of 10 in. diameter were laid about 2 ft. apart through the concrete mass. These pipes were employed to keep the space behind that section of the dam clear of water up to a certain time, and were then tightly closed with pine plugs. The dam was built in comparatively short sections by filling the timber forms above mentioned with concrete, and in the entire structure 30,000 cu. yards of concrete were used.

At the right-hand end of the dam, on the Auburn side of the Androscoggin, come the head gates of the canal, eight in number. See Fig. 2. Each of these gates is 7 ft. wide, 15 ft. high, and is moved by hand gearing so nicely adjusted and designed that one man can handle a gate. The Holyoke Machine Company is the maker of these gates.

Above the datum plain taken for this work the top of the spillway of the dam is 105 ft., and the top of the flashboards is 108 ft., which latter is the normal height of water behind the dam, in the canal and in the forebay at the power house. In width the 700-ft. canal is 80 ft., and as it is cut through rock its sides are nearly perpendicular. At the forebay, where the water stands in front of the steel racks, the elevation of the rack floor is 88 ft., so that the water there is 20 ft. deep. A few feet back from the face of the rack the forebay floor rises to the level of the canal bottom at 90 ft. The main turbine wheels are set in their chambers with shaft centers at an elevation of 94 ft., or 14 ft. below the water level in the forebay. Normal tail water level is 78 ft., or 30 ft. below the surface of water in the forebay, and 16 ft. below the shaft centers of the main turbines.

At the power house side of the forebay comes the head wall,

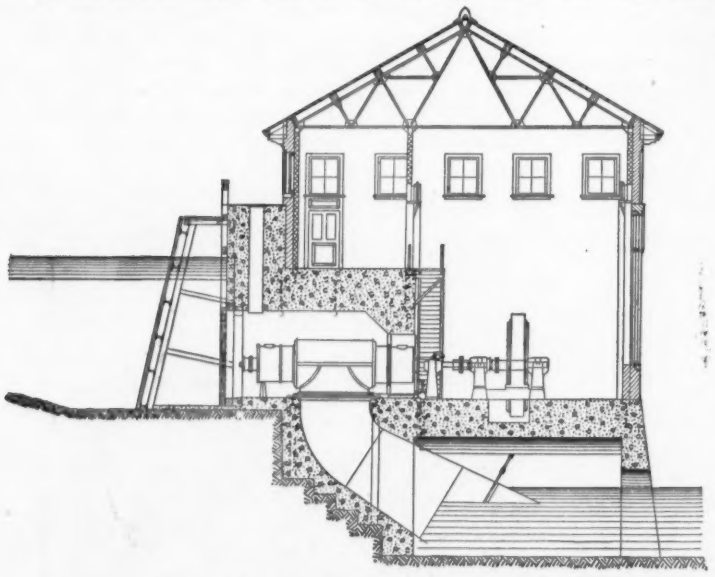


FIG. 3.—TRANSVERSE SECTION OF POWER HOUSE.

119 ft. long and 24 ft. 3 in. thick up to within 1½ ft. of the water level. This head wall serves also as one side of the power house, and to contain the chambers for the turbine wheels. (See Fig. 3.) The entire foundations of the power house, including the head wall, are of concrete, and this construction extends from the bottom of the tail race, at an elevation of 69 ft., to the floor of the generator room, at an elevation of 89.50, on the down-stream side. On the forebay side of the power house the concrete wall runs up from an elevation of 69 ft. to an elevation of 106.5 ft., where an offset of 17 ft. in width is made to serve as a switchboard gallery. The wall then goes up to an elevation of 115 ft., where it is 7½ ft. wide on top, and carries the gearing for seven gates that close the openings into as many wheel chambers beneath in the great concrete wall. A little in front of this 24-ft. concrete wall, which serves at once as the head wall of the forebay and the up-stream side of the power house, there is a steel rack 119 ft. long and rising from the floor of the forebay at an elevation of 88 ft. to an elevation of 113 ft., or 5 ft. above the normal water level. At the face of the wall are the gates for the wheel chambers already named. Each of these chambers is formed in the concrete mass of the 24-ft. wall, and has its floor level at an elevation of 89.5 ft., or 6 ft. below the bottom of the canal, and 18.5 ft. below the water level in the forebay. The wheel chambers extend entirely through the wall, but each is closed with a water-tight bulkhead on the down-stream side, and through this bulkhead the wheel shaft passes into the generator room. There are seven of the wheel chambers, five for the wheels of main generators and two for the wheels of exciters. Each chamber for the main wheels is 14 ft. wide and 11 ft. 4 in. high, with a single 9-ft. circular opening in its floor for a draft tube. Each of the chambers for exciter wheels is 5.5 ft. wide and 11.5 ft. high, with an opening in its floor 4 ft. 4 in. in diameter for a draft tube. From the top of the concrete head wall of the forebay, at an elevation of 115 ft., a manhole 24 by 30 in. in rectangular cross-section extends vertically down into each wheel chamber, so that access may be had to one wheel set while the others are in operation.

Above the concrete foundation and head wall, from an elevation

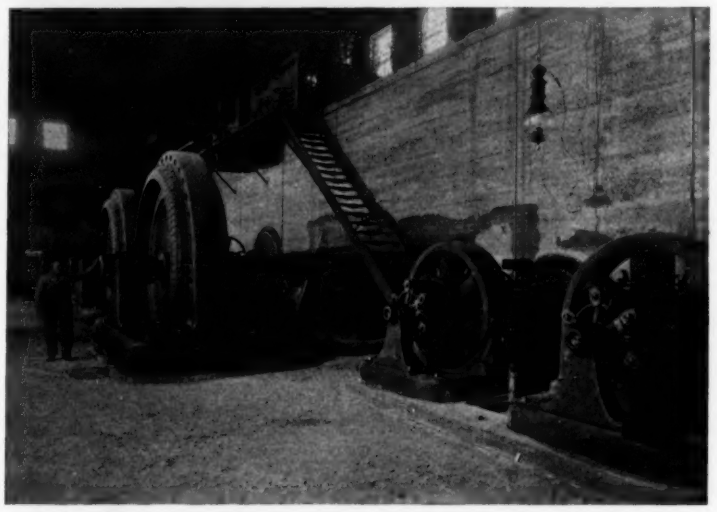


FIG. 4.—THE GENERATORS AT DEER RIPS.

of 89.5 ft. on the tail water side, and from an elevation of 106 ft. on the forebay side, the walls of the generating station are of brick reinforced by steel, and the ends are also of brick. The steel columns in this case are not embedded in the brick walls, save as to short lengths near the floor line, but are interior to them. A third row of steel columns is set along the top of the head wall near the line where it drops to the level of the generator room, and these columns, with those on the tail water side of the station, support the tracks for the crane that sweeps the entire area of that room. Steel roof trusses span the entire interior width of the station, and support a slanting roof of plank, tar and gravel. The lower cords of these roof trusses are 35 ft. 8 in. above the concrete floor of the generator room, and 18 ft. 8 in. above the like floor of the switchboard gallery. In its interior the station is 134 ft. 8 in. long by about 43 ft. 6 in. wide. The generator room and the switchboard gallery each occupy this entire length, and of the total width the former room has nearly 28 ft. on the tail water side, while the remaining width of nearly 16 ft. is taken up by the switchboard gallery. This gallery, being directly above the wheel chambers, has its floor 17 ft. higher than that of the generator room, and an iron staircase is used in passing between them.

The floor of the generator room is 11.5 ft. above the normal level of tail water, and 18.5 ft. below the water surface in the forebay. Light in the station is received through small high windows along the forebay side and ends, and through long windows on the tail water side. Each of the five main wheel pits is designed to contain one pair of turbines mounted on a horizontal shaft and discharging through a single draft tube between them. Two pairs of these turbines are now in operation, each pair being made up of 42-in. Victor wheels, which operate at 180 r.p.m. and are rated at 1,300 hp. After passing through the water-tight bulkhead, the shaft from each pair of these main wheels is direct connected to a 750-kw, 10,000-volt, 60-cycle, three-phase generator, shown in Fig. 4. These generators are of the revolving-field type, and were made by the General Electric Company, as were also the exciters and the switchboard apparatus. Current from these generators is carried to oil switches on the switchboard gallery through lead-covered, three-phase cables laid in ducts beneath the concrete floor. Each of the two smaller wheel chambers contains one pair of 17½-in. Victor turbines with common draft tube and horizontal shaft. These wheels

operate at about 460 r.p.m. and are rated to deliver 250 hp. In the generator room, on the extended shaft of each pair of these smaller wheels, there is a 100-kw exciter dynamo.

In the switchboard gallery, a short distance from the operating board are the three-pole oil switches in cells of brick and concrete. (See Fig. 5.) These switches are of 1,000 hp capacity each, and serve to connect the main generators and transmission lines. Besides the control switches, the marble operating board carries a full

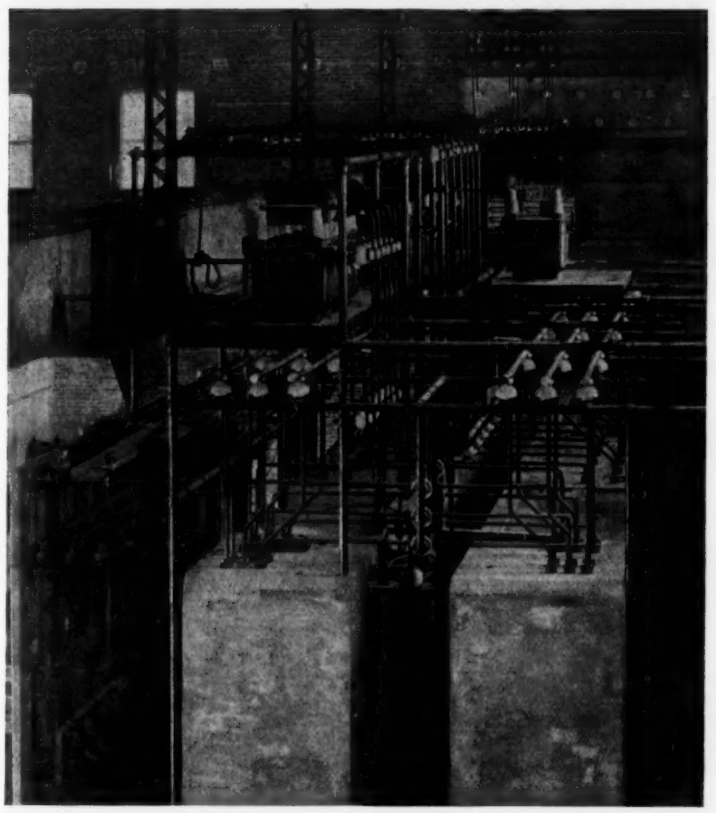


FIG. 5.—BEHIND THE SWITCHBOARD AT DEER RIPS.

set of indicating instruments and a recording wattmeter for each generator. That part of the power house now completed provides room for the two exciters and their wheels, and for five sets of main wheels and generators, but the other five sets for which the original plans provide can be housed by extending the present building at one end. Only two of the five main generators for which the present power house provides are now in operation, but the other three will be added before the load reaches a point where they are necessary.

Power from the plant at Deer Rips is transmitted to the sub-station of the Lewiston & Auburn Electric Light Company, in the former city, at 10,000 volts, three-phase, and is there transformed to 2,200-volt, two-phase current. There are now in use two three-phase circuits carried on a single line of wooden poles. Each of these circuits consists of three aluminum cables, and each cable is made up of seven No. 8 B. & S. gauge wires. Knowles H. G. glass insulators, each 6¼ in. in greatest diameter, support these cables, and are in turn mounted on wooden pins that have been treated with paraffine. On each pole two cross arms are secured, a four-pin arm near the top and a two-pin arm underneath. Two cables of a circuit are strung on one side of each four-pin arm, and the third cable is secured to the insulator on the two-pin arm underneath, so that the three cables have the common distance of 18 in. between them. Before the aluminum conductors pass out of the generating station to the pole line, and just after they enter the sub-station, a series of General Electric air-gap lightning arresters is connected to each.

The room used as a sub-station is formed entirely of brick and concrete masonry, and adjoins the old electric light station in Lewiston. In this room, a view of which is given in Fig. 6, there are at present five 500-kw General Electric transformers of the air-blast type. Four of these transformers are connected in pairs on the Scott system, while the fifth is held in reserve. The current from these transformers passes from the sub-station apartment into the adjoining station of the Lewiston & Auburn Electric Light Company, where the switchboard for city distribution is located. In this room

series arc dynamos, 110-volt dynamos connected to a three-wire system, and a 550-volt generator for direct-current motors, are driven by turbine wheels which draw water from the falls at Lewiston. All of this local generating equipment will eventually be superseded by the 2,200-volt, two-phase current, which already supplies a large part of the connected load. Owing to the lack of power, pending the completion of the new generating station at Deer Rips, the rise of the electric load at Lewiston and Auburn has been retarded, but from this time forward it may be expected to increase rapidly. At the present time the connected load of the Lewiston & Auburn Electric Light Company includes 21,093 incandescent lamps, 497 arc lamps, of which 431 are enclosed, and 67 motors, with an aggregate rating of 666 horse-power. These motors are in part of the direct-current and in part of the induction type. The largest size of motor now in use is 75 hp. Besides the above loads, power is being supplied for the operation of the Lewiston, Brunswick & Bath Street Railway, at a sub-station of that company where two rotary converters of 200 kw capacity each, with their transformers, are already in position, and a new 400-kw rotary converter with transformers is about to be added. This 400-kw converter is of the Westinghouse make. It is the intention to attract a very large motor load to the distributing lines in Lewiston and Auburn, and to this end consumers who use a maximum of 20 hp will be supplied at the rate of $30 per hp-year of 3,000 hours of operation, as a flat rate. A consumer who uses 30 hp or over at maximum load can purchase electric current at a flat rate of $25 per hp-year of 3,000 hours. These rates are very

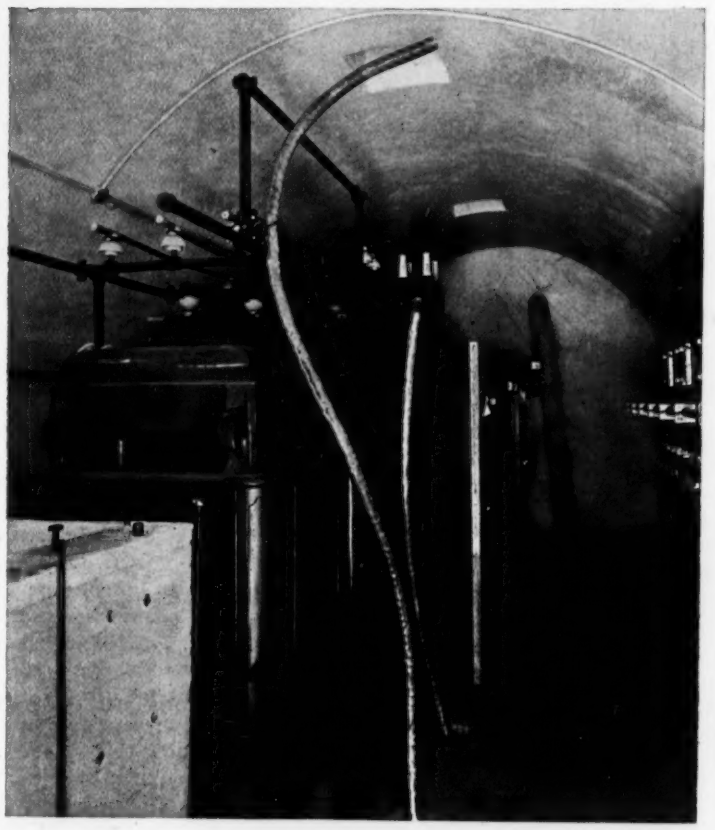


FIG. 6.—TRANSFORMER ROOM AT LEWISTON.

low for electric power of the amounts named, and should result in the rapid growth of a large motor load in Lewiston and Auburn.

In both of these cities electric supply is carried out by the Lewiston & Auburn Electric Light Company. This company is in turn controlled by the firm of Libbey & Dingley. This firm also owns the above electric water power development at Deer Rips, and sells energy to the Lewiston & Auburn Company for distribution.

Designs for the dam and water power station were made by I. W. Jones, Milton, N. H., but the work has been executed under the direct and constant supervision of Mr. W. S. Libbey, senior member of the firm of Libbey & Dingley. The facts treated in the present article have been obtained through the courtesy of Mr. W. S. Libbey, Mr. H. T. Sands, electrical engineer and superintendent of the Lewiston & Auburn Electric Light Company, and of Mr. F. D. Gordon, assistant superintendent.

The Edison Electric Company's System in Southern California.—V.

SINCE the articles were written on the power transmission and distribution system of the Edison Electric Company, of Los Angeles, appearing in the issues of February 25, March 4, 11 and 25, some important improvements have been made, and work mentioned as under way has been completed.

Active construction work is now progressing on the Santa Ana No. 2 power plant, the concrete walls of the station now being put in place. The tunnel work is practically completed and the machinery is ready for installation. The equipment will consist of two 800-hp Doble water wheels, operating under 305 ft. head, each direct-connected to a 750-volt, three-phase alternator. The speed of each unit is 176 r.p.m. Two exciters, each driven by a 40-hp Doble wheel, are also to be installed.

The Lytle Creek station is now in operation, feeding 10,000-volt current into the transmission system at Colton. The installation consists of two 500-hp Pelton water wheels, operating under a head of 480 ft., each driving a 11,000-volt, three-phase alternator.

Since the first of the year active construction work has again been instituted on the Kern River No. 1 plant, the work having been temporarily suspended until the three stations in the Los Angeles Valley were nearly completed. Plans are now being made for a 25,000-kw installation at the Kern River plant, the equipment to consist of five 5,000-kw, three-phase alternators, driven by tangential water wheels under a net effective head of 865 ft. It is stated that specifications have recently been issued by the company for about 1,000 steel towers, which are to be used in the proposed transmission line from the Kern River plant to Los Angeles, a distance of 116 miles. A branch from this main transmission line will also probably be built to Santa Barbara to supply power for the railway and lighting property in that city, which is owned by the Edison Company. The steel towers for the transmission line will vary from 30 to 60 ft. in height and will be spaced about eight or ten to the mile. It is probable that a double three-phase transmission line will be erected on the one set of poles, the potential being 60,000 volts.

Work on the No. 3 combined power and sub-station in Los Angeles has progressed satisfactorily. The second 2,000-kw Curtis steam turbo-alternator has been installed.

One of the most important improvements that have been effected is the completion of a 30,000-volt steel-pole, long-span transmission line from the No. 3 station in Los Angeles to Inglewood, a distance of 14 miles. This line is probably the only one of its character in this country and its construction is somewhat unique. The poles are of built-up construction, which consists of three U-bars arranged in triangular form and held in place by means of inside and outside collars at right angles to the axis of the pole and placed at intervals of two or three feet along its length. The poles are 75 ft. long and are set up one-tenth of their length in a cylinder of concrete, a ground wire and plate being installed so as to avoid receiving a shock from the poles in case of imperfect line insulation. The poles are spaced 250 to 275 ft. apart, and carry two or four steel cross arms, each composed of two U-bars 10 ft. in length. The hub of the cross arm is expanded to fit the pole and the two bars on each side of the center are firmly bolted together with blocks which hold lead-top, standard-thread steel pins. For a distance of over a mile five three-phase circuits are carried on the pole line, two of 30,000 volts and three of 15,000 volts. Two of the 15,000-volt circuits branch off on a separate steel pole line to a local sub-station in the southern part of the city, and the other 15,000-volt circuit supplies power for manufacturing interests along the Los Angeles River. The two 30,000-volt lines extend to Inglewood and are there tied in through a transformer station with the 17,000-volt lines supplying the coast towns from Santa Monica to Long Beach. At corners double steel cross arms are used, and some of the corner poles are made self-sustaining without guys by means of cable trusses.

On the whole this transmission line has proven very satisfactory. It was designed by and installed under the supervision of Clem. A. Copeland, at that time superintendent of distribution of the Edison Company. The steel poles and cross arms were built by the Franklin Rolling Mills & Foundry Company, of Franklin, Pa. The lead-top standard pins were furnished by the Oliver Iron & Steel Company, of Pittsburg, and the porcelain insulators by the R. Thomas Company.

The Power Installation of a Coffee-Roasting and Spice-Grinding Plant.

BY H. S. KNOWLTON.

CONTINUOUS success in the preparation of food products depends upon the maintenance of a high standard of purity perhaps more than upon any other factors. Especially is this true in the process of blending, separating, roasting, cooling and packing coffee, and of grinding and packing spices. The cleanliness of electric power and illumination, therefore, offer special advantages to large coffee roasting and spice grinding houses, and in the recently completed plant of the Dwinell-Wright Company, at 311 Summer Street, and 329 A Street, Boston, there may be found an interesting example of the latest practice in the application of electricity to the preparation of coffee and spice on a large scale.

The Dwinell-Wright Building is a seven-story structure of the mill type of construction, the walls being of buff brick with pink granite trimmings. Its length is 100 ft. and its width 90 ft. An abundance of natural light and ample ventilation are secured by 219 windows. The foundations rest upon 1,400 35-ft. piles, and there are streets on three sides of the building 70, 80 and 100 ft. wide. On the fourth side is a solid fire-proof party wall. In the rear of the building is a spur track of the New York, New Haven & Hartford Railroad, which enables shipments to be handled with promptness and convenience. Wagon shipments are handled with despatch upon the A Street side without blocking the sidewalk and street, since the building stands back from the street.

Adjoining the offices on the first floor is a coffee testing room equipped with a battery of six roasters and with electrically-driven mills for grinding samples. The practice of roasting green coffee before purchasing large lots has grown to be so important that the testing room is one of the most essential departments of the business. In older days samples were roasted by a corn popper, but in the Dwinell-Wright plant the requirements are such that electrically-equipped roasters had to be installed in order to keep pace with the business. The allotment of work upon the various floors of the building will be considered in connection with the installation of mechanical and electrical equipment.

The boiler room is located in the sub-basement. It contains a 130-hp Kendall horizontal return tubular boiler 72 in. in diameter

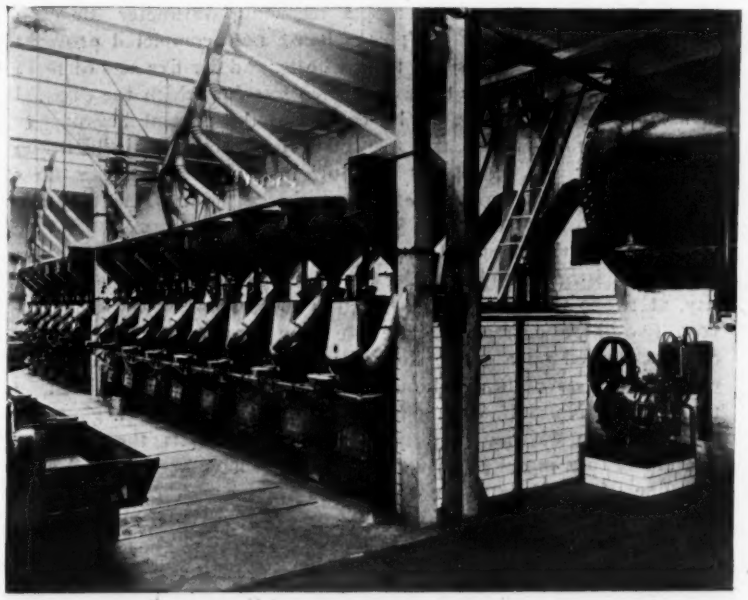


FIG. 1.—VIEW OF ROASTERS.

and 19 ft. 6 in. long, built for a working steam pressure of 125 pounds per sq. in. The shell is of firebox steel 15/32 in. thick, and the heads are of flanged steel ½ in. thick. There are 92 steel tubes 3½ in. in diameter and 18 ft. long, and the grate surface is 66 in. wide by 72 in. long. The boiler was figured 1 hp to each 13 sq. ft. of heating surface and will evaporate 30 pounds of water per pound of coal per hour. It was supplied by the Charles River Iron Works, of Cambridgeport, Mass., and is equipped with a Sidney Smith setting that consumes its own smoke. Return condensations from the engine room and heating system are led back to the boiler

through a National feed water heater, which shows an absolute raising in the temperature of the water, between its entering point and where it feeds the boiler, of over 125°. The pumps comprise a 4-in. by 5-in. by 5-in. Blake steam heating vacuum pump and a Blake duplex feed pump 5½ in. by 3½ in. by 5 in. in cylinder dimensions. The steam-plant drips are piped to a blow-off tank located beneath the boiler room floor, which is of cement. The piping is arranged to by-pass the equipment for cutting it out in case repairs or inspection are needed.

The engine room is located in a corner of the basement, and it contains two generating units. One of these is a 120-kw, three-phase, 60-cycle, 220-volt Westinghouse alternator of the revolving armature type, running at 720 r.p.m. and belted to a 14-in. by 36-in. non-condensing Brown engine. The other unit is a 4-kw, 220-volt, direct-current Westinghouse generator, direct-driven by a Sturtevant engine of the vertical, center-crank type. The smaller machine is used for supplying various lights at night after the larger unit is shut down. 220-volt lamps are used throughout the building. The Brown engine runs at 105 r.p.m. and has a flywheel 12 by 21 in. with a weight of about 8,000 pounds. The dimensions of the crank-pin and crosshead pin are alike, each being 3½ in. by 4 in. The valves are slide valves, the engine being equipped with two steam and two exhaust valves of the multiported type. In case the valves and seats become worn they can be quickly and easily removed and made tight by scraping to a true bearing. Every portion of the wearing surfaces of both valves and seats is covered at every stroke, so that no shoulders are formed, and the valve seats follow up their wear indefinitely. The cylinder clearance is about 2½ per cent., and the guaranteed steam consumption 24 pounds per hp-hour. The engine was built by C. H. Brown & Co., of Fitchburg, Mass. The exciter for the alternator consists of a 1.87-kw, 100-volt Westinghouse direct-current generator belted to the alternator shaft and making 1,800 r.p.m. There are two switchboards in the engine room. One controls the alternator and the lighting feeder and motor circuits, and the other controls the small lighting unit, carrying a double-pole, double-throw switch for connecting the office lights either on the direct-current machine or upon one phase of the alternator. The main switchboard panels are each 24 in. wide by 90 in. high. They carry standard switches and instruments. The feeder panel carries a polyphase recording 220-volt wattmeter, and all switches are connected to enclosed fuses on the rear of the board. Blue Vermont marble is used for the various panels.

The wiring throughout the plant is of the open type, water-proof circuits being installed in the basement. A striking feature is the use of three-phase induction motors. Every machine in the establishment is motor-driven, either by direct connection or belting from jack shafts, and there is not a direct-current motor on the premises. The advantages of the induction motor in the driving of food-preparing machinery are considerable. The fire risk is practically nil, the cost of attendance and repairs is less than with direct-current machines; there are no rheostats to give trouble and most of all the induction motor permits a cleanliness of conditions unequalled by any other form of propelling machinery.

With the exception of the small space occupied by the boiler room and coal pockets, the entire sub-basement is devoted to the receiving and storing of green coffee obtained from Arabia, Brazil, Jamaica, Java, Venezuela and other points. A large part of the basement proper is also devoted to the storage of raw coffee. On this lower floor the first step in the blending process is carried out, after which the coffee is conveyed to the next floor by a belt bucket elevator, whence it passes to the separating machines. After cleaning, the various sized coffee beans are deposited in separate metal bins. On the second floor the separating and grading machines are belt-driven by a 7.5-hp Westinghouse type C 220-volt, three-phase motor, making 1,120 r.p.m. This motor also drives the bucket elevator mechanism. On the same floor is a 3-hp, 1,700-r.p.m. motor, driving two glueing and folding machines, an automatic weighing machine and an air-pump. These machines are used in connection with the packing of spices, the process being semi-automatic.

A printing-office is located in a corner of the first floor above the basement, for printing labels, folders, etc. The press is driven by a 2-hp induction motor making 1,700 r.p.m. All the motors but two are Westinghouse type C's. The well-known advantages of motor driving in printing-press work are all reaped to the full here, the cleanliness of the process being the particular point of interest.

The two freight elevators of the plant are each a Moore & Wyman drum machine, 4,000 pounds capacity, and driven by two type F Westinghouse induction motors operating at 220 volts, three-phase. Each motor has a full load output of about 15 hp, the speed at no load being 900 r.p.m. The controller consists of two main drum switches, a primary and reverse drum switch and a secondary drum switch. The primary and reverse switch is operated directly by the elevator cage rope, and is used to connect the primary of the motor to the line, and to reverse the motor. The secondary switch cuts resistance in or out of the secondary circuit of the motor. The movement of the rope to start the elevator by closing the primary switch winds up a spring which in turn moves the secondary switch. The rate at which this switch revolves is determined by an adjustable dash-pot, which allows the motor to be started as gradually as desired. The rheostat consists of resistance grids mounted near the controller.

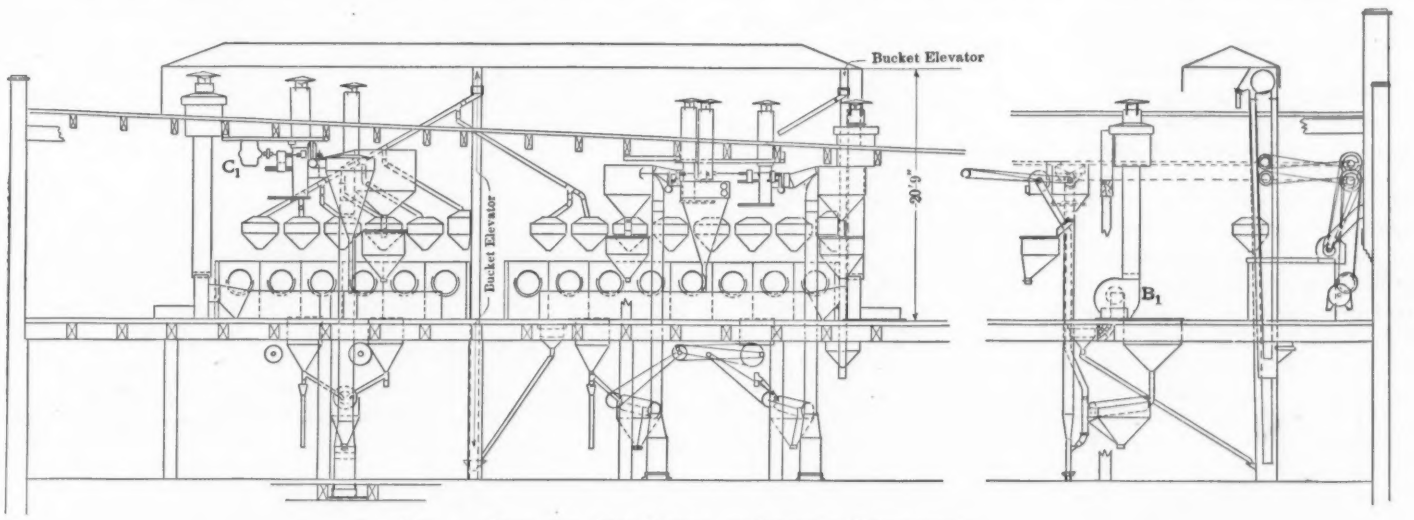


Fig. 2.—Side and End Views of Roaster Equipment.

From the metal bins on the second floor the separated coffee is next carried to the top floor, deposited in large bins, and after being passed through an automatic weighing machine it is drawn off into 100-pound sacks. Upon this floor the roasting and grinding are done, and this is perhaps the most interesting part of the establishment. An all-glass monitor roof provides for a liberal supply of natural light in this department. The capacity of the roasters installed on this floor is 70,000 pounds per day. All the special roasting and storing, separating and grinding machinery was installed by Messrs. Jabez Burns & Sons, of New York. Gravity hauling of the raw material and product is in use wherever possible.

The coffee is stored on the top floor prior to roasting, and it is then sent to the roasters by two bucket elevators. The roasters are in two batteries of eight and six machines, respectively. They are illustrated in Fig. 1. Each battery is driven through direct gearing by a 10-hp induction motor making 840 r.p.m. The general layout of the roasting and storing apparatus on the top floor is shown in Fig.

2. Fig. 3 shows the cooling and exhauster plant in perspective.

Each coffee roaster has above it at the front a feed hopper into which a charge of green coffee is put ready for spouting into the roaster when the roaster is ready for it. The roasting takes place in perforated cylinders which are mounted on a shaft which is turned continuously by power applied at the rear. Brickwork encloses the cylinders, forming firebox and ashpit. Grates are provided suitable for burning hard coal and coke, which are the usual fuels, but gas or any smokeless fuel can be used by applying a suitable burner in the firebox. In the Dwinell-Wright plant the feed hoppers are filled by branch piping from the bucket elevator. This piping has Y gates and connects with each feed hopper, so that the green coffee falls by gravity into the roasters. From two to three hundred pounds of coffee constitutes the charge of each cylinder, and the average time for roasting each batch is about 30 minutes. The elevator for each battery of roasters and the blast fan which provides artificial draft for the coke fires are driven by belting connections from the pinion shaft at the back of the roasters. The 10-hp roaster motors are mounted on brick bases faced with white enamel brick to match the end walls of the brickwork which encloses the roasting machines. The roaster cylinders are provided with flanges to mix the coffee thoroughly and prevent uneven roasting.

In the roasting of the coffee it is necessary that the process be watched constantly by skilled laborers and at the precise moment when the color of the coffee beans shows that the roasting has been accomplished to give a certain flavor, the coffee is tilted out of the roasters into cars or cooler boxes (Fig. 3) which are then pushed on tracks to a cooler pipe connected with an exhaust fan, by means of which the air of the room is sucked through the layer of coffee, through the perforated bottoms of the coolers, and discharged through the roof. The cooling process is further facilitated by spading the coffee over and over by hand. The coffee in this battery of machines might at one time have a value of $500. Some part of this would be so near to complete roasting at any one time that it would be quickly spoiled if the motion of the roasting cylinder should suddenly be stopped. Quick cooling after roasting is essential, as the hot coffee would grow darker in color and actually take fire if left in a considerable mass without having air drawn through it. Although the operations are all made as automatic as possible, the actual roasting of the coffee depends upon the judgment of the operator. The fans are driven by two 7.5-hp motors running at 1,120 r.p.m., each motor being direct-connected to a 45-in. Sturtevant steel exhauster. The cooler boxes of the plant are of the so-called "tip-top" pattern, because the upper part is arranged to tip on the truck base, for the purpose of discharging the coffee, after it is cooled. The coffee is dumped from the cooler box into an opening in the floor large enough to receive two roastings of coffee. From this hopper the coffee passes on, first to a revolving screen, which sifts out all small materials, second, to a chaff pipe, up which there is a light suction of air to remove substances lighter than sound coffee, and third, to a stoner pipe, up which there is an air current sufficient to lift the coffee itself, leaving any heavy particles like stones and nails at the bottom of the "stoner boat." The cleaned coffee carried up by the air current is deposited in the hopper above, from which it is drawn out into cars which transfer it to storage bins in the story below. From these bins the coffee is withdrawn as required for packing and shipping. The object of removing chaff and small particles from the coffee is to make it more attractive to the buyer. The removal of stones, etc., is necessary to prevent damage to the grinding mills through which the coffee must pass before it is finally used. The revolving screens are driven by two ½-hp motors direct coupled to the driving shafts. The stoner and chaff fans are driven by two direct-connected 7½-hp motors.

The present tendency in such plants is toward the use of separate motors as far as possible for driving groups of machines. This results in considerable economy, in being able to stop fans, etc., when they are not needed, and another important point is the doing away with considerable belting over the roasting machines, where the conditions as to temperature, moisture and dirt are bad for belting.

Coffee grinding is also done on the uppermost floor of the building, four grinders and a bucket elevator for feeding them being driven by a 1-hp motor running at 1,700 r.p.m. and installed on the ceiling. After being ground the coffee drops by gravity directly from the mills into the automatic weighing machines on the fourth floor.

Running from the basement to the top of the building is a link belt package elevator and lowerer installed by the Link-Belt Engineering Company, of New York. It is driven by a 2-hp motor located on the top story. The carrier is of peculiar design, as it was necessary to make the floor openings only 26 in. by 28 in. on each side, in order to conform to the Fire Underwriters' rules. The elevator raises and lowers packages placed upon it by hand, measuring 22 in. by 17 in. by 28 in. high or less, the weight of each package not exceeding 100 pounds. The elevator is 69 ft. on centers and consists of two strands of link belting with trays attached at intervals of about 20 ft. The spacing rods of the trays are extended and travel in angle steel runs both ascending and descending. Two take-up bearings are provided at the foot to enable slack in the chain to be adjusted. The driving machinery connecting the motor to the head of the elevator was arranged so that the elevator will automatically stop in case any neglected package attempts to pass over the head.

On the fourth floor four automatic weighing machines are operated by a 5-hp motor running at 1,120 r.p.m. This motor also operates a carrier belt system which disposes of the various cans of coffee after they are packed. The packing is carried on in two departments—whole coffee and ground coffee—and the entire floor is devoted to packing for shipment. On this floor is an outfit of box-making and nailing machinery driven by a 2-hp motor. The wooden

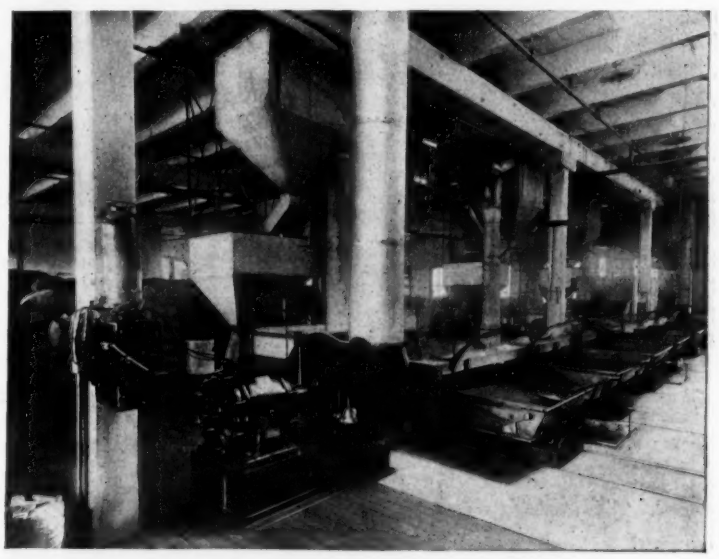


FIG. 3.—COOLING AND EXHAUSTER PLANT.

boxes or cases are received in the form of shooks and are made into boxes on this floor. There are also two ½-hp motors operating screeners and a ½-hp motor, which drives a sifter.

The third story and a part of the second are occupied by the spice department. In addition to its coffee business the Dwinell-Wright Company also controls the importation, blending, grinding and packing of the well-known "Royal" spices. Here automatic sealing and weighing machines supplement hand labor, and largely increase the output. There exists a considerable demand for power for spice grinding. The motor equipment for this floor comprises the following: One 10-hp motor driving a 30-in. Holmes & Blanchard cayenne pepper mill and bucket elevator; a 10-hp motor connected to drive, one at a time, three vertical spice grinders, pepper sifters and pulverizers; one 10-hp motor driving two spice mills, a bucket elevator and sifter; a 10-hp motor operating a 36-in. grinder, two elevators and two sifters, and a 10-hp motor operating two iron mills, feeding and sifting apparatus. A 7½-hp motor will soon be added to drive a 40-in. grinder, bucket elevator and sifter. In the cayenne pepper room particularly, the advantages of the induction motor over commutator types of motors are apparent. Pepper dust has little effect upon the operation of an induction motor.

The present schedule of motors figures a total of 27. The lighting load is large enough and the disposition of the motors is such that no trouble is experienced in the illumination on account of the operation of the motors.

The officers and directors of the company are: President, George C. Wright; vice-president, J. H. Dwinell; treasurer, George S. Wright, and Messrs. Richard O. Miller and Charles H. Holland.

The company is a Massachusetts corporation and has been in business since 1845. In its organization and equipment the plant stands as one of the largest and most modern establishments of its kind in the world.

Transformer Practice.

By C. W. Humphrey.

It is a conceded fact that, of all the apparatus used in the equipping of an alternating electrical distribution system, the transformer is the most abused piece of apparatus—partly due to the fact that it will fulfill all requirements without attention, and also to the difficulty of investigating its actual working conditions. If a little more attention were given to this subject a great many partial shut-downs and inconveniences caused by the burning out of transformers might be avoided, and considerable money could be saved annually by systematic investigations and careful records kept of the performance of transformers in service.

In the purchase of new transformers to supply the constantly increasing demands on distribution systems, it is of the utmost importance to have the proper information at hand, and not have to depend on the printed ratings and schedules of losses as furnished by the manufacturing companies. A great many of the smaller stations do, however, have to depend on these printed data, as their comparatively small purchases would not warrant the necessary expense entailed in performing tests to ascertain such data.

In order to obtain the proper information for the intelligent purchase of transformers, it is necessary to procure for comparative tests a transformer of each of the different makes now on the market. Most of the larger manufacturers are willing to submit transformers for test wherever an order of any considerable size depends on the results obtained in a comparative test. The tests necessary to obtain data to judge of the relative values are as follows:

A re-rating test to determine the true capacity of a transformer; a test for iron and copper losses; a test for overload capacities, regulation and parallel operation and for insulation resistance. Other interesting tests might be made, but these are considered of the most importance. I will describe briefly some of these tests, and endeavor to explain the methods used and the reasons for the same.

The re-rating test is made in order to place all transformers on the same basis of comparison, and also for future reference, so that transformers may be loaded according to their true capacities. In doing this it is necessary to adopt arbitrarily a standard temperature rise, and in this instance a maximum temperature rise of 50° C. above the surrounding air was adopted, all coil temperatures being measured by the rise of resistance method. That is, the true capacity of a transformer is considered as that load at normal voltage and a power-factor of 100 per cent, which will heat up the transformer coils to such an extent that the hottest coil after a continuous run will be just 50° C. above the temperature of the surrounding air. The one factor which limits the size of a transformer is the maximum temperature obtained in any one part of any of the coils. It is not safe to take the manufacturers' rating of a transformer, for in many instances the actual capacity of a transformer varies very widely from that given by the manufacturers, and in most cases some variation will be found. In making this re-rating test, the transformer is given a load equal to about normal rating and left until the temperature in the coils amounts to about 45° C. above the surrounding air, then, if the temperature still seems to be on the increase, the load is decreased until a steady temperature is obtained. The load is then continually adjusted until the temperature in the hottest coil becomes steady at 50° C. above the surrounding air. This load is considered as representing the actual full-load capacity of the transformer.

This method gives us the true rating of a transformer as near as it can be obtained at the present time, although it is not absolutely correct, as the temperatures measured by the resistance method are the average of the whole coil, the outside windings of the coil being the coolest and the inside windings the hottest. The inside windings are unable to radiate their heat directly, and hence become much hotter than that part of the coil which is in direct contact with the oil. If it were possible to obtain the greatest maximum temperatures reached, these would be the temperatures to use in the re-rating tests. This maximum temperature may be obtained approximately, however, by taking the temperature with a thermometer on the outside of the coil and assuming this to be the minimum temperature. Having the average and the minimum, it is a very easy matter to calculate the maximum. A number of errors enter into the calculation, however, due to the fact that the oil, which is also in contact with the thermometer, receives some of its heat from the core of the transformer and from the other coils. So, even at the best, with this method of calculation, one is not getting the correct temperatures of the coil under test. Transformers are frequently found in which that part of the core surrounded by the coils heats more than the coils themselves. The transformer though having the best oil circulation, is the one showing the least difference between average and minimum temperature readings.

If a transformer were especially wound with small wires tapped on to the wires in the coil about every 10 ft. and brought out to be used as voltmeter leads, the correct temperature could be obtained for every part of the transformer coils, and it would be possible to learn a great deal concerning the construction of the transformer. No doubt some of the companies manufacturing transformers have experimented along this line.

To illustrate the wide variations that I have obtained in these tests on transformers of different makes, table I shows the actual results as obtained on these different transformers of standard makes:

TABLE I.—RERATING TESTS.

Rating		Temperature Rise							
				By thermometer.		By resistance.		Theoretical rise.	
Mfrs.	Actual Capacity.	Oil.	Core.	Sec.	Prim.	Sec.	Prim.	Sec.	Prim.
7.5 K. W.	6.75	36.3	41.2	42.	42.6	49.	46.5	56.	50.4
7.5	9.07	34.3	41.	42.	42.6	49.8	45.	57.6	47.4
7.5	6.1	25.8	39.7	33.2	33.2	50.2	42.2	67.2	51.

It will be noted that the first transformer has a capacity below the manufacturer's rating, the difference between the maximum and minimum temperatures being small, showing that the transformer has good oil circulation, but is deficient in radiating surface or copper cross-section. As a matter of fact, the case on this transformer is the smallest of the three, while that of the second is the largest. The last transformer on the list shows the lowest capacity, and deductions would seem to indicate that this transformer has large external radiating capacity, but that the coils are so wound that the heat on the inside has no chance for being radiated except through the coil itself and the core.

The iron losses on these transformers were measured in the customary way; that is, by measuring the watt consumption on open circuit at normal operating voltage.

The copper losses were measured by short-circuiting the secondary coil through an ammeter, and impressing sufficient pressure on the primary coil to obtain full load reading on the ammeter.

The watts consumption with ammeter losses subtracted will be the copper loss. These losses were taken hot and are of sufficient accuracy for all commercial purposes, though not quite as accurate as might be obtained by more elaborate methods.

Table II shows the losses obtained by the above methods, together with the percentage of losses, as given by the manufacturers. The copper losses at the true rating are also given.

TABLE II.—LOSSES.

Losses at 7.5 K. W.						Copper loss at true rating.
Cop. loss.		Per cent.	Iron loss.		Per cent.	
145.5			134.5	+	27.	95.6
140.	+	7.7	104.6	—	2.2	204.
139.	+	15.7	100.	—	7.5	75.4

It will be noticed that the second transformer comes more closely to manufacturer's published results than the others.

A great deal also depends on the overload capacities of a transformer, as most central stations depend entirely on the overload capacities of their transformers to carry the peak load. This peak in residence districts rarely lasts over one hour, hence for that kind of service transformers may be loaded to such an extent as to give a maximum temperature rise of 50° C. when run at that load continuously for one hour. In the business district, however, the peak usually lasts from three to five hours, and transformers located in these districts may be loaded accordingly without endangering the life of the transformer.

The economy of overloading transformers both in operating costs and initial investment is very evident and may be very readily calculated.

These same transformers were tested for overloads, and the time in hours required to bring their maximum temperatures to 50° C. above the surrounding air was noted. Table III shows the results obtained.

TABLE III.—OVERLOAD.

Hours unit at....	7.5 K. W.	10 K. W.	12 K. W.	15 K. W.
	13.	5.5	2.75	1.25
		6.	4.	2.5
	10.	6.5		

These tests were made with transformers initially cold, and do not show the safe overloads the transformers will carry after previously being heated upon a lighter load.

The parallel operation of transformers is another item of vital importance and should not be overlooked when purchasing a different make of transformer. Transformers of different characteristics will not divide the loads proportionally when operating in parallel, and sometimes transformers of the same make and size vary to such an extent that it is not advisable to operate them in parallel unless they be spaced quite a distance apart. It is even possible for transformers operating in parallel to divide their load so unequally that the transformer having the best regulation will take sufficient load to cause it to burn out. In such a case one would naturally think that the poorer transformer was the better of the two, unless the cause of the burn-out had been looked into very carefully. This is not necessarily true, however, for I have known transformer manufacturers to build transformers of very high initial efficiencies by sacrificing the insulation to gain the desired end. A poor grade or iron used sparingly will give very nearly as large iron losses as other transformers having more iron but of better quality.

The transformers mentioned above were also tested for parallel operation; first they were tied together on a two-wire, 110-volt system and then on a three-wire system with a 50 per cent. unbalanced load. The results were as shown in Table IV.

TABLE IV.—UNBALANCING.

110-volt secondary two-wire system. Amperes in each:

47·3
50.
34·3

110-220 volt three-wire system. 50 per cent. unbalanced.

Positive.	Neutral wire.	Negative.
27.	45·5	72·5
32·5	35·5	68.
34·	·5	34·5

There are several other tests which might be made to furnish very interesting results, but the foregoing I believe to be of the most importance. These same tests if made on the same transformers after having been in service for a year would show much different results. The most important factors governing the lasting qualities of a transformer are the ageing properties of iron used in the core and the oil used for cooling.

The data given in the tests outlined above will be sufficient upon which to base our calculations and to reduce the different items down to a monetary basis to determine the relative commercial values of the different transformers. The annual running expense of a transformer should include interest on the investment, a sinking fund laid aside each year, which in a given number of years will be sufficient for the purchase of a new transformer, a charge for losses at so much per kw-hour, based on the actual generating expenses per kw-hour and a certain fixed yearly capacity cost for each kilowatt of demand on the station caused by the transformer losses.

In my calculations I will assume cost of generation at 1.5 per cent. per kw-hour, capacity charge of $18 per kw of demand, interest at 6 per cent. and depreciation 6 per cent., compounded for twelve years.

These figures are based on the actual rating of the transformer, the yearly copper loss being assumed as equal to full load loss for three hours daily, and the cost of the transformer being assumed at very nearly the quoted values. The calculations on this basis are shown in table V.

TABLE V.—TRANSFORMER COSTS.

Cost of Transformer.	Losses for 1 hour.	Copper loss 1 year.	Iron loss 1 year.	Total loss per year.
$79.00	230 watts	104.7 K.W.H.	1178 K.W.H.	1282.7 K.W.H.
82.00	309 watts	213.4 K.W.H.	916.3 K.W.H.	1129.7 K.W.H.
74.00	175.4 watts	82.6 K.W.H.	876 K.W.H.	958.6 K.W.H.

Capacity K. W.	Cost of losses.	Capacity cost.	Interest.	Depreciation.
6.75 K. W.	$19.24	$4.14	$4.74	$4.69
9.07 K. W.	16.95	5.56	4.92	4.86
6.1 K. W.	14.38	3.16	4.44	4.38

Total cost for one year.	Running expenses per year per K. W. of capacity.
$32.81	$4.86
32.29	3.56
26.36	4.32

The great difference when it comes down to a monetary basis will be readily seen, and if purchases were made according to these figures a different transformer would be selected than would be the case if entire reliance were placed upon the manufacturers' statements.

After the purchase of a transformer, great care should be exercised in properly locating it upon the lines, and if tied in on a network, the output should be measured from time to time to see that the load is properly balanced and the transformer not overloaded to too great an extent. Careful and systematic testing of the loads on transformers will insure good and economical operation. For instance, if a transformer is connected upon a three-wire network, each side of the transformer is supposed to carry one-half of the load, and if this is not the case one side may be heavily overloaded, while the transformer on the whole is underloaded.

This may be readily seen by referring to Table IV, on parallel operation with a 50 per cent. unbalanced load. It will be noticed that one of the transformers has 27 amp. flowing in one side and 72.5 amp. on the other side, while the normal current should be 49.7 amp. The transformer considered as a whole is carrying full load, but one side is carrying an overload of 109 per cent., which would be sufficient to burn out the transformer if the load was continued for any great length of time.

The above will show the necessity for carefully watching the operating conditions of transformers while in service. Frequent investigation should be made, especially during the fall of the year, for at that time the conditions are varying very widely, due to the rapidly increasing load.

A great many times transformers, apparently destroyed by lightning, were abused more or less in the above manner until the insulation became charred, and when subjected to a hard strain during a lightning storm the insulation broke down and burned out the transformer. The effect was attributed to lightning, when in fact, if proper precautions had been taken when placing the transformer in service, the trouble would never have occurred.

Flux Distribution in Design.

BY A. PRESS.

It is usual in ordinary engineering practice to pay little attention to the distribution of flux in electromagnetic machinery. In many cases an attempt at a more or less exact theoretical determination is impossible, and one must needs resort to experiment. The system of calculation in which the arithmetical average density and path of flux is taken will, in certain well-defined cases, lead to quite appreciable error, and it is the purpose of this article to indicate two cases: one connected with plunger magnets, and the other the apparent discrepancy in the calculated iron loss known to occur in the quite common types of transformers.

Although the magnetomotive force which tends to send flux through any magnetic path surrounding and surrounded by the electric current is constant in any chosen circuit, it does not follow that the flux density is the same throughout all sectional areas of the magnetic path, since, obviously, the reluctance will be greater the longer the path, while the change in the density itself also produces a change in the specific reluctance of the magnetic material. It follows from this that in testing iron for permeability a moderate variation in the inner and outer radii from the arithmetical mean radius will make quite an important difference in the real magnetic density obtaining near the outer border with reference to the inner edge of the testing ring.

The combination of these facts will influence greatly the calculated results obtained in many practical problems, such as that connected with the pull in plunger magnets, which depends upon the sum of the squares of the densities at all of the points, and the more familiar problem concerning the hysteresis and eddy-current losses in the cores of transformers or in armature structures of dynamo electric machinery.

If it be assumed that, as a close approximation, the relation between the magnetism and the magnetizing force, with iron in the magnetic circuit (the B H curve) may be represented by an equation of the form $B = a H^m$, it will be found that amount of discrepancy between theoretical and observed results will depend very much upon the value assigned for the exponent m. With a magnetic density (B) not exceeding about 7,000 lines per square centimeter in soft iron, the magnetization curve approaches the

axis of B, but at an induction of greater value the curve approaches the axis of H.

Taking a practical case where the exponent m in the equation above has a value of 2, the ratio of the actual magnetic pull to the pull as ordinarily calculated on the basis of uniform density, the total flux being the same in each case, is expressed as follows:

$$\frac{\textit{Actual pull}}{\textit{Apparent pull}} = \frac{L^2 + l^2 + Ll}{3\,Ll},$$

and for $m = 3$.

$$\frac{\textit{Actual pull}}{\textit{Apparent pull}} = \frac{4}{5} \cdot \frac{L^3 - l^3}{(L^2 - l^2)^2} \cdot \frac{L - l}{Ll}.$$

It is thus seen that with the ratio of maximum and minimum stream lines given as $\frac{L}{l} = 2$ the amount of the discrepancy would be 38 per cent.!

Turning now to the case of transformer iron loss, two factors call for reconcilement with theory. The one is that the observed eddy current loss is in many cases considerably above the calculated, and the second that apparently, according to the experiments of Messrs. Mordey and Hanson,* the eddy current loss must follow some other law than B^2, though it is stipulated that this is only when the law of hysteresis is taken as the 1.6th power of B. If due regard were given to the form of the $B\,H$ curve of soft iron and also of the distribution of flux in the transformer core, no additional hypothesis would be required to explain the first apparent discrepancy with regard to the eddy current loss. However, as to the second, if the law of hysteresis loss over the working range is that of the second power of B and not the 1.6th power, the fact that the *static* hysteresis loss is always less than the observed *total* iron loss is no valid argument that the hysteresis under actual working conditions may not be considerably greater. It would follow from this that necessarily it does not mean that provision may have to be made for a considerable eddy current loss. The eddies may be still negligible, even though there be an increment due to distribution and the nature of the $B\,H$ curve over the working range. It is to be regretted that Messrs. Mordey and Hanson have not given the form of the hysteresis loss curve for the sample under test.

In transformer calculations it is usual to take account of the average density and not the actual densities. It is the average density that is taken to vary as a sine function of the time to give a sine wave of e.m.f. and if, as before, one will investigate the more accurate theoretical eddy loss for the cases where the $B\,H$ curve is represented by the equation $B = a\,H^m$ with no greater density than 7,000 B, the ratio of actual eddy loss to apparent eddy loss would be given where $m = 3$ by

$$\frac{\textit{Actual eddy loss}}{\textit{Apparent loss}} = 2 \cdot \frac{L^2 + l^2}{L^2 + l^2 + 2Ll}.$$

In the same way, assuming that the hysteresis loss depends upon the square of the actual maximum density, curiously enough, the same ratio as previously for eddy losses will be obtained.

In the limit it is thus seen when $l = 0$ the discrepancy in the total iron loss would be 100 per cent.! Therefore, cases where from 20 to 50 per cent. error would occur should be not at all unlooked for. It is a strange fact, but if the value of m is taken as less than 3 and the index for hysteresis loss less than the square, as for example the 1.6th power, the mathematical work will show a decrement instead of an increment. Thus one is driven to the conclusion in view of the observed facts that the hysteresis loss goes up as the square of the density in many cases. It is worth noting that if the densities in transformers are taken beyond 7,000 B, the value of m in the $B\,H$ equation changes from a multiple value to a fractional value. Hence, above 7,000 B the eddy loss, which is assumed to depend upon B^2, would be less than ordinarily calculated, which would, of course, show itself as apparently causing the eddy losses to follow a law less than the square of B. Thus in testing iron for designing purposes it is important that the proportionality of parts should be adhered to, i. e., various ratios of L to l should be investigated and in dynamos the ratio of pole pitch to depth of armature core should be gone into.

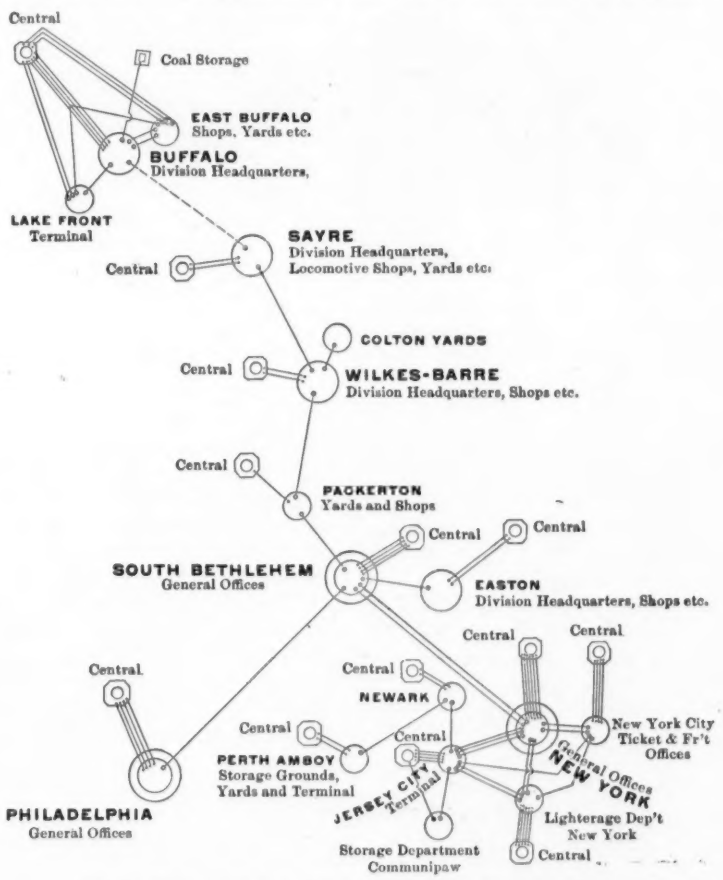
*See paper read before Section G of British Association.

The Telephone in Railroad Service.

The telegraph service of the Lehigh Valley Railroad within the past few years has been brought to a high state of efficiency under former Superintendent J. W. Lattig and his successor, Mr. J. H. Jacoby, and concurrently with this development the telephone has been incorporated with equally important and beneficial results.

A long-distance line has recently been completed to Sayre, Pa., and while it is strung on the same poles with the telegraph wires, some of which are operated at a potential of 350 volts, the service is stated to be highly satisfactory. The telephone line is stated to be entirely free from any inductive effect due to its proximity to the telegraph circuits, and it is said that it is possible to conduct a conversation between the terminal points, a distance of 271 miles, in an ordinary tone of voice.

The successful operation of telegraph and telephone circuits on the same line of poles is a difficult problem, owing to induction of the telegraph currents. Transposition of the telephone wires is the usual corrective of this evil. Mr. Jacoby has found that the transposing must be carried out in strict accordance with well settled rules, and that mere approximation thereto is not sufficient to attain



TELEPHONE TRUNK LINES, LEHIGH VALLEY SYSTEM.

satisfactory operating results.. It is to the extreme precision in the matter of transpositions that can be attributed the successful operation of the Lehigh Valley line.

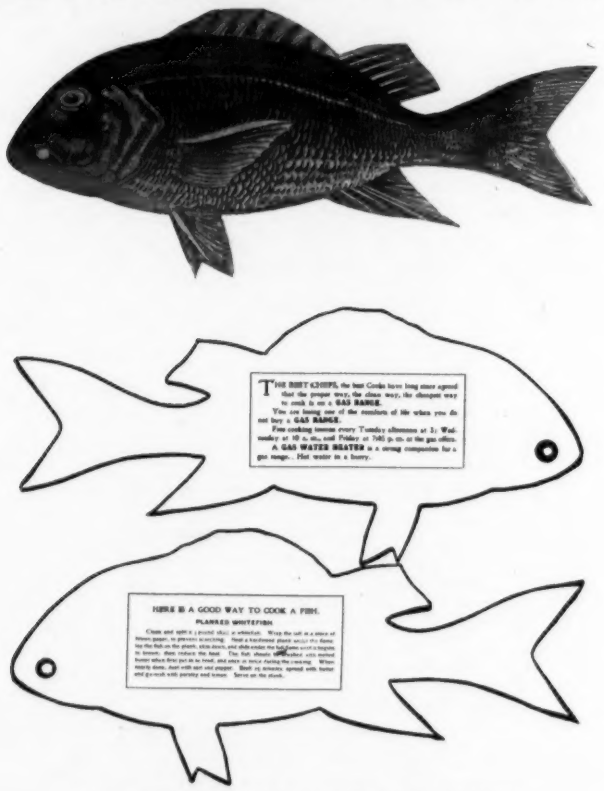
The company's railway system is covered by a very comprehensive and flexible telephone plant, as may be seen from the accompanying diagram. At each important railroad point connection is had with the central exchange of the regular telephone company, and by means of private branch exchanges any point on the road is enabled to reach any other point. Even the residences of the officials can be reached at any time, day or night.

Work and tool trains have been equipped with portable telephone sets by means of which the dispatcher can be communicated with from any point on the road. Connection with the telephone circuit out on the road is effected by means of a simple device, which is readily hooked on to and removed from the wire, no cutting of the wire being necessary. Sidings and other points are provided with connections to the nearest telegraph office so that train crews may keep in touch with the dispatcher while they are out on the road. Various composite, or simultaneous, telegraph and telephone circuits are also in use. One of these circuits is 87 miles in length.

It is metallic, and from it one telephone and two telegraph circuits are obtained. It is an important link in the general system, and connects the exchanges forming part of the intercommunicating system. It is an old telegraph circuit, and was not built especially for telephone work, and although it is on the same pole line with other wires it operates with very satisfactory results, the wires being properly transposed throughout.

Central Station Advertising.

We have before referred to the highly effective advertising methods of the Denver Gas & Electric Company. While the illustrations herewith do not relate to the electrical end of its business, they are typical of the scheme adopted. In the same line is a set of handsome menu cards, the subjects being dinners in different national styles. For a Spanish dinner, for example, the card has a handsome engraving of a female figure in national costume, and recipes are given of the dishes that will be cooked in the presence of those invited who attend at a given hour at the office of the company. The invitation is in the name of the cooking demonstrator; in fact, a notable part of


THE BEST COOKS, the best Cooks have long since agreed that the proper way, the clean way, the cheapest way to cook is on a GAS RANGE.
You are losing one of the comforts of life when you do not buy a GAS RANGE.
Free cooking lessons every Tuesday afternoon at 2; Wednesday at 10 a. m., and Friday at 7:30 p. m. at the gas office.
A GAS WATER HEATER is a strong companion for a gas range. Hot water in a hurry.
HERE IS A GOOD WAY TO COOK A FISH.
PLANKED WHITEFISH

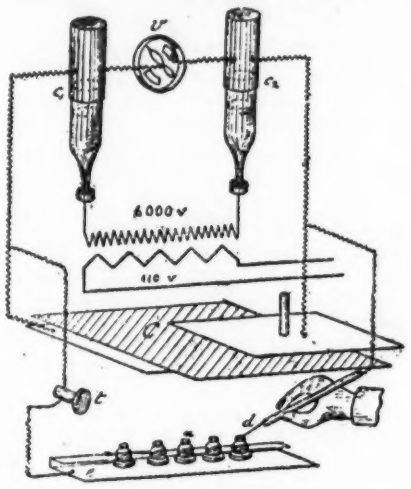
FIGS. 1, 2 AND 3.—FISH DESIGNS IN ADVERTISING.

the method of advertising is unobtrusiveness with respect to the company's name, and absence of commercial claims, the point being made by the pictorial or other salient feature.

The accompanying illustrations show three of the four sides of two fish-shaped cards; the small circles represent the holes at which the two parts are hinged by an eye.

Testing of Grounding Devices.

In a paper dealing with abnormal potential strains in alternating-current circuits, which was read before the Russian Technical Society by Mr. P. A. Kovalef, there is included a brief description of apparatus conveniently arranged for obtaining and measuring the e.m.f. impressed upon automatic grounding devices being tested for minimum operating voltage. The disposition of circuits is represented diagrammatically in the accompanying illustration. V is an electrostatic voltmeter, whose terminals are connected to the plates of two condensers, C_1 and C_2. In series with these two condensers, which are of constant capacity, is connected a third condenser, c, whose capacity can be varied at will. As shown in the cut, the electric power is received at a potential of 110 volts, which is raised to 6,000 volts by means of a stationary transformer. The three condensers just described are connected in series circuit across the secondary of the transformer. The voltage across each condenser will vary inversely with the relative capacities of the individual condensers, so that any desired e.m.f., not exceeding 6,000 volts, may be obtained across the terminals of the condenser of variable capacity. In parallel with this latter condenser and with the electrostatic voltmeter is placed the grounding device to be tested. In the local test circuit is connected a telephone receiver, which serves for detecting



TEST CIRCUITS.

when the device has operated. The combined capacity of the two condensers, C_1 and C_2, determines the maximum current which can flow through the grounding device when short-circuited by the arc formed when it operates, and as this capacity is placed at a very small value, the test circuit is amply protected from excess of current.

Control of Compensated Motors.

In the application of alternating current to electric railways it is found that for lines within the limits of a city alternating current at a high potential is not suitable, and, consequently, it is desirable to supply electric roads from two sources, one furnishing alternating current for use outside of cities and the other furnishing direct current for use within the city limits. An invention patented March 14 by Mr. C. P. Steinmetz, as noted in our last issue, has for its object to provide an efficient control system by means of which electric motors may be operated on either alternating or direct current.

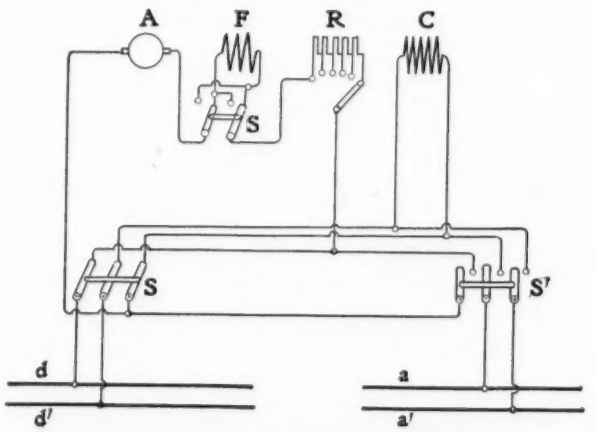


FIG. 1.—DIAGRAM OF CONTROLLING CIRCUITS.

The motor used is provided with three sets of windings, as shown in Fig. 1, the armature winding indicated by A, the field winding F, and the compensating winding indicated by C. The compensating winding is mechanically so placed as to be inductively related to the armature winding, so that when the two are connected in series the magnetomotive force of the current in the one winding opposes and neutralizes the effect of the other and thereby enables the motor to operate on direct current with a field weaker than otherwise would be possible. For operation on alternating current, the use of a small number of field turns is especially advantageous, since the reactance of the field may thereby be rendered quite small, the power factor correspondingly increased, and the torque characteristics im-

proved. In order not to be limited to a specific voltage during alternating-current operation, the inventor proposes to connect only the compensating coil to the source of alternating current, using the armature winding as the secondary of the transformer thus obtained and connecting the field coil as a load circuit on the transformer. The ratio of the e.m.f. impressed upon the compensating winding and induced in the armature winding may be made anything desired by properly proportioning the relative number of the two windings, and higher alternating voltage may be used. For direct-current work all three windings of the motor are connected in series to the source of supply.

The electrical interconnections of the motor circuits are shown in Fig. 1, where *d d* represents a source of direct current, *a a* represents a source of alternating current, the three-pole switches *s* and *s'*, being closed for direct and alternating-current operation, respectively. The magnetic relations of the circuits are more clearly indicated in Figs. 2 and 3. It will be observed that for direct-current work the motor is a pure compensated series machine, but that for alternating-current work the connections used convert the machine into a modified form of repulsion motor, the e.m.f. counter generated at the brushes due to speed in no wise affecting the magnetism in the primary of the transformer (the compensating

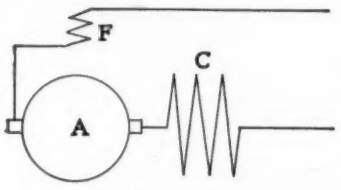


FIG. 2.—CONNECTIONS FOR DIRECT CURRENT.

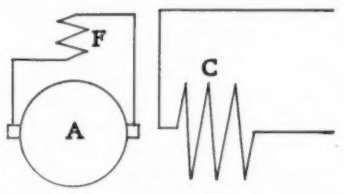


FIG. 3.—CONNECTIONS FOR ALTERNATING CURRENT.

coil). While the claims of the patent are not limited to any special method of interconnecting several motors, for four-motor equipments the preferred method is to connect the individual series-wound compensated motors in parallel one with the other for direct-current work, and for alternating-current work to join the primaries of the individual motors in series, the secondaries being connected in parallel. In either case the method suggested will overcome any tendency for a single motor to race and rob the others of power, while the series connections of the primaries with adjusting resistance in the secondaries will allow high alternating e.m.f. to be used directly on the motor circuits.

Recent Electrochemical Developments.

Electric Furnace Invention.

One of the most important problems in electric furnace construction is to find a suitable refractory material for furnace linings. According to the temperature to be attained in the electric furnace different materials are used. The most refractory material known at present is carbon; when used for furnace linings, it should be employed in the form of charcoal, since its electric conductivity is low. Next in the series of refractory materials, arranged according to the temperature, is carborundum. The temperature limit to its use is the point at which it decomposes, the silicon escaping as vapor and the carbon remaining as graphite. Next in the list of refractories come the "silico-carbides" (siloxicon, etc.). The temperature limit to their use is the temperature of the formation of carborundum. Some valuable practical notes on the use of carborundum and silico-carbides for furnace linings were recently given by Mr. F. A. J. Fitzgerald (*Electrochemical Industry*, November, 1904). We may simply mention here that it is not necessary that the furnace lining should be homogeneous throughout, but that the refractory qualities of ordinary fire brick, magnesia brick, etc., may be be greatly improved by being washed over to a depth of a half millimeter or so with a more refractory material. It may also be noted that the above mentioned refractories which are most suitable for high temperatures, are themselves products of the electric furnace.

In this connection a patent recently granted to Mr. H. G. Turner is interesting. It refers to the use of magnesia as a refractory. It is proposed to heat magnesite—*i. e.*, magnesium carbonate—in an electric furnace at the temperature of the electric arc to a point where the material crystallizes. It is then cooled, ground and mixed with a suitable binding material, like water glass, and the mixture is applied either as a wash to the walls of the furnace or formed into bricks. Nothing is said in the patent concerning the temperature which this refractory will stand. According to a recent Faraday Society paper of Mr. E. K. Scott, who made experiments with this new refractory, pure magnesite, such as the Indian, when crystallized, does not run at ordinary electric furnace temperatures, and the temperature obtained in the aluminothermic reaction has no effect on it.

Another important detail of electric furnace construction is the material for electrodes. On account of its much higher electrical conductivity and of its excellent mechanical properties (ease of machining) artificial graphite has become very popular during the last years as electrode material in electric furnace practice. Its only disadvantage is its high conductvity for heat. This may have the effect that the outer end of the graphite electrode becomes so hot that it must be cooled artificially. A patent recently granted to Messrs. E. F. Price, G. E. Cox and J. G. Marshall, of the Union Carbide Company, refers to details of construction of graphite electrodes, especially for use in calcium carbide furnaces. The electrode consists of several graphite rods, placed side by side, water-cooled at the outer end and at the same time reinforced and strengthened at that place by means of a refractory cement which prevents oxidation of the graphite.

The case of machining artificial graphite is made use of in a gas-tight electric furnace for heating materials in a vacuum or in an atmosphere of any gas, recently patented by Mr. William C. Arsem, of the General Electric Company. The crucible to be heated is inside a tubular helix of graphite which serves as heater. To concentrate the heat to the space which it encloses and which contains the crucible, a refractory screen is placed around the tubular helix of graphite.

New Telephone Patents.

Automatic Exchange System.

Messrs. J. K. Norstrom and Henry M. Graif, of Chicago, have patented a system for automatic exchange working which greatly reduces the number of switching machines required. Heretofore it has been customary to provide one complete switching machine with a full multiple of contacts for each line. In the present system a few machines only are provided, and these are so arranged and controlled with respect to the lines that the first idle machine of the series becomes associated with any line from which a call originates. Thus, if line No. 50 wishes to call, the first operation of the user is to select a machine by the manipulation of his keys. A simple pressure on one of these serves to connect his line with machine 1 if this be idle. If this be busy, machine 2 will be automatically tried and so on until an idle one is found. From this point the selection of the desired machine proceeds as usual for automatic systems. The patent for this improvement has been assigned to the Automatic Telephone Company.

A New Repeater.

Another attempt to solve the repeater problem has been made, this latest effort being described in a patent granted to Emory Parsons, of Chicago. The apparatus consists of two receiver parts connected in parallel and actuating two diaphragms, both of which affect the same microphone button. There is apparent no particular feature to recommend this device more than many of its predecessors.

Novel Switchboard System.

A rather novel switchboard system has been brought forward by I. Kitsee, of Philadelphia, in which many of the functions now performed by the operator are automatically carried out. When a call is received this is indicated by a call lamp upon a lamp board set at right angles to the switchboard proper. At the same time as the call light appears a busy light associated with it appears to notify all operators that the line is busy to incoming calls. As the lines end in plugs at the answering position, just as in some of the earliest multiple switchboards, it is necessary for the operator to respond by connecting herself to the proper cord. She does this by touching the plug to her listening circuit terminal. As she raises the plug the call lamp goes out. On ascertaining the desired connection, if the

busy lamp of the desired line be out, then the operator raises the plug to the desired jack. This latter has a magnetic core, while the plug contains an electromagnet and the circuits established cause the plug to adhere to the jack. As soon as the connection has progressed thus far the called station bell begins to ring and it will so continue unless the desired station answers, or the calling station gives it up. Whenever the hook is depressed at the calling station the plug circuit is broken, the solenoid demagnetized and the plug falls to its socket by gravity, being guided by the cord and weight.

AN IMPROVED DESK STAND.

An improved desk stand is shown in Fig. 1, which is so designed that access may be had to the switch springs without in any way disconnecting the wiring. The form of stand shown is merely one

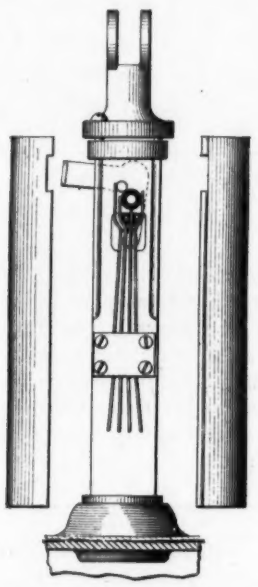


FIG. 1.—MASON DESK STAND.

of many suggested forms within the scope of the invention, for the patent covers any form of tubular casing which may be moved in sections to expose the working parts without affecting the wiring. Mr. C. T. Mason, of Sumter, S. C., is the inventor of this desk stand.

A NEW HAND GENERATOR.

A new hand generator has been patented by W. Kaisling, of Chicago, which is particularly designed to be cheaply manufactured in quantities. Machined parts are largely omitted, sheet and rolled parts being substituted. The usual *H* armature is used, but the shaft is

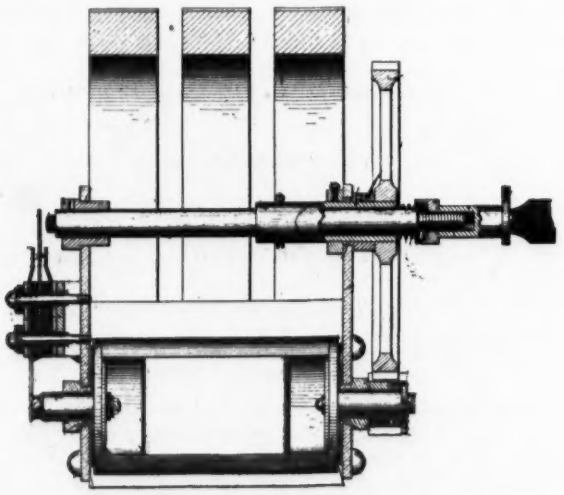


FIG. 2.—KAISLING HAND GENERATOR.

connected to the core not directly, but to end plates, is shown in Fig. 2. It will thus be seen that the armature may be simply machine-wound. The pole pieces are cut off bar sections, and they are wedged into place by sheet metal end plates, which carry the bearings for both armature and crank shafts. The Stromberg-Carlson Company has been assigned the patent.

SELECTIVE SYSTEM.

A lock-out selective system in which the selection depends upon the synchronous action of spring-driven clockwork at the various stations, has been patented by John P. Jackson, of Orleans, Ind. When a connection has been established all other stations but those involved in the connection are excluded until the lapse of a predetermined time, when the connection is automatically broken and the line opened to all.

LETTER TO THE EDITORS.

The Metric System.

To the Editors of Electrical World and Engineer:

SIRS:—In attacks on the metric system, much has been made of a formidable table of names of so-called units which are asserted to survive in countries where the metric system has been legally adopted, and some ardent anti-metricists have even presumed to offer this list as conclusive evidence of the failure of the metric system in such countries. Refute the survival of the old units, they exclaim, or acknowledge the failure of the metric system; and if one notes among the strange collection a few which have come under his observation and points out their sorry status, quickly comes the cry of victory. Behold, out of the many hundreds he can only challenge a paltry three or four, thus admitting the superiority of the old systems over the modern one seeking to drive them out!

To make a detailed examination of a list such as that offered, containing many hundreds of names, would indeed be a difficult task, even if the names referred to units in active use. Each citation would require a special investigation; and if we should finally affirm that such and such a pound is not used in Hamburg or Bremen, the answer would apt to be that we have simply not been able to discover it. So long as no investigation is made under responsible governmental auspices, it is useless to attempt to convince a partisan of this view by simply contradicting him; for no matter what pains one may have taken to learn the truth, he will continue to attribute to such a city or such a province a unit which is never used in that locality.

My arguments on this question have been of another nature. I believe I have shown in these pages that a single glance at the table referred to will disclose gross errors of principle in its constitution; errors in countries; errors in names; errors in incorporating in the table units purely metric.

I recently had occasion to talk with a high official of the Normal-Aichungs Commission of the German Empire, the learned Prof. Weinstein, and had the pleasure of hearing him say that outside of the *pound* of 500 grammes (the word being simply a common name for ½ kilogramme), the numerous units of mass mentioned in the widely-circulated table are completely unknown to the German public to-day. It would be childish to deny that in some households there are scales equipped with weights which date from a time previous to the metric reform and which still serve a domestic purpose; but to grant this offers no support to a charge that the metric system has encountered great opposition in Germany.

I have already pointed out that the existence of non-metric countries compels the use of foreign units in countries where the metric reform has been accomplished. This is a necessity of international trade. What can be concluded from this? Simply that complete harmony is retarded by the opposition to the metric system in certain countries. Anti-metric partisans are, therefore, scarcely fair in reproaching us with our tolerance. For example, Switzerland, which is an export country, has a law authorizing the use of non-metric units in commerce with countries where the metric system is not allowed. In other countries the law is less explicit, but the tolerance is there.

The British units still occupy a large space in the Japanese tariff. This is not to be wondered at, since the Empire of the Rising Sun carries on the bulk of its trade with England and America. If Japan had seen the least advantage in the British system, which tends to impose itself upon that country in so many ways, both political and commercial, it would surely have been adopted. The action of Japan seems to indicate that they found it decidedly imperfect. It is quite evident that the Japanese legislators looked well into the future and were convinced that the British must gradually be displaced by the metric system.

To repeat an old argument, in the majority of countries where the metric system has been welcomed as a benefit, it replaced an enormous number of local systems, which greatly complicated and hampered domestic business transactions; and its intrinsic advantages were reinforced by the fact that it substituted simplicity and order for complexity and anarchy. If it is true that the Anglo-Saxon countries, while legalizing a large number of units, have but a small number (as few as 19, it has been claimed) in practical use, then the adoption of the metric system might be less advantageous in their case than in that of countries where this unification is less advanced. If, however, we consult the report of the investigation made in England by the Society of Inspectors of Weights and Measures, we find in different regions not less than 50 units which are not included in the legal table of British measures, to say nothing of 21 other units used for measurement of cereals in the United Kingdom. What a comment this is upon the statement "That measured by the number of units in common use and by their uniform value in all sections and in all industries, we have the simplest and most uniform system of weights and measures of any country in the world."

But if we consider *en bloc* the countries which now employ the British system it is readily apparent that a new system of weights and measures would do away with a confusion analogous to that which has disappeared from all the countries where the metric system has been legally adopted.

In conclusion, the love of tradition, the beauty of a common tie other than that of language between the many countries which the Anglo-Saxon race has filled with its characteristic activity, has given to the partisan of the British system an argument not without weight; but this argument has received a severe blow in New Zealand, where a law has recently been passed for the immediate adoption of the metric system. Thus the union is broken and its disintegration is only a matter of time. In the United States the question should be put only in the following form: Will the great American Republic exert upon progress the great influence of its voluntary adoption of the system, or will it wait and be forced by exterior pressure, which some day will become irresistible?

SEVRES, FRANCE. CH. ED. GUILLAUME.

DIGEST OF CURRENT ELECTRICAL LITERATURE

DYNAMOS, MOTORS AND TRANSFORMERS.

Temperature Experiments with Insulating Materials and Field Coils.—RAYNER.—An abstract of a report on temperature experiments carried out at the British National Physical Laboratory. In Part I, dealing with the effect of heat on the electrical and mechanical properties of dielectrics, it is stated that from experiments on cotton-covered wire there appeared no serious alteration in the cotton up to 125° C. (which temperature may be taken as approximately the safe limit); above 125° C. the cotton gradually became darker, but retained its good electrical (but not mechanical) qualities up to the highest temperature employed, viz.: 180° C. The mechanical tests consisted of a punching test and bending test. It was thought that there might be some relation between the ohmic resistance and disruptive pressure, but tests showed this not to be the case to any great extent. Moisture has an important effect upon the insulation resistance, as will be seen from the following experiments: A specimen of press-spahn, 1.07 mm. thick, which had been in the desiccator for 12 days, had reached the high figure of 800,000 megohms, having started with an initial insulation resistance of 0.42 megohms. A similar piece which had been heated for an hour reached a figure above 4,000,000 megohms, showing that the desiccated specimen still contained an appreciable amount of moisture. Another piece of press-spahn, also 1.07 mm. thick, was exposed to intermittent sunshine out of doors (October 23). During the previous days there had been much rain, and the air could not be termed dry. Resistance before exposure was 0.84 megohms, and the resistance after 70 minutes' exposure was 630 megohms. A very interesting series of tests relating to the disruptive voltage of various substances which had been treated with Berrite varnish proved that very high disruptive strengths may be attained in this way. The highest disruptive strength quoted is 65,000 volts per millimeter for "Excelsior Paper No. 3," heated to about 80° C. Nearly all the materials thus tested could be bent around a cylinder 1/16 in. in diameter without breaking. The second part of the report deals with an investigation undertaken at the request of the committee on electrical plant of the Engineering Standards Committee, who desired to know what, in actual practice, was the difference between the maximum temperature reached in field coils and the mean temperature calculated from the increase of resistance of the coil. Thermo-couples were used for measuring the temperatures. Nine different forms of coil were tested. Fig. 1 shows coil No. 6 tested and Fig. 2 represents the results of these temperature tests. This coil belonged to a 200-kw, 220-volt generator running at 350 r.p.m. The load on test was a little over half-load. The rated full-load shunt current was 11.4 amp., and while running during the test the current was 7 amp. The coil had 34 layers (cast-iron former), the coil being varnished on the outside. The curves in Fig. 2 refer (*A*) to running loaded, 7.07 amp. (mean temperature 44.0° C., maximum minus minimum 2.4°); (*B*) to the armature standing and a current of 7.09 amp. (mean temperature 50.2° C., maximum minus minimum 2.1° C.); (*C*) to the armature standing, current 11.12 amp. (mean temperature 92.5° C., maximum minus minimum 8°). It is said that "the entire report, which covers 47 pages, and contains a number of tables and curves, should be in the hands of every dynamo designer. It is obtainable from the Engineering Standards Committee.—Lond. *Elec.*, March 17.

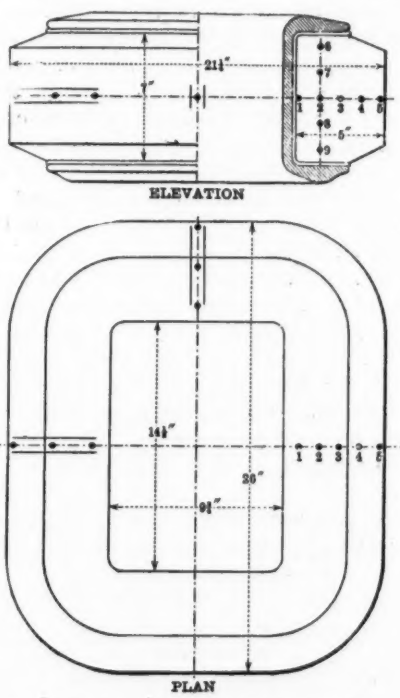


FIG. 1.—TEMPERATURE EXPERIMENTS.

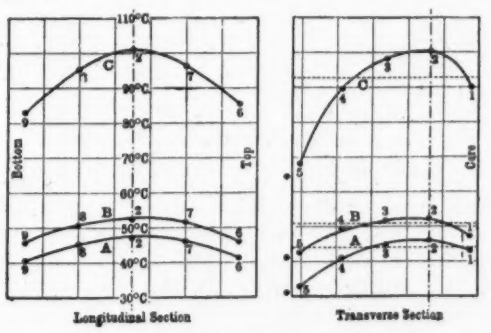


FIG. 2.—TEMPERATURE EXPERIMENTS.

Copper-Carbon Brushes.—PRASCH.—A description of copper-carbon brushes of Endruweit. They are made in two forms, as elastic

and as hard brushes. The elastic brushes are made of electrolytically-deposited pure copper layers alternating with very thin layers of carbon. The copper is said to act almost alone as conductor. Commutation is stated to be absolutely sparkless and the wear and tear of commutator and brushes to be very small. It is said that these brushes have been found to be specially suitable for high-speed dynamos directly coupled with steam turbines. The hard type of brushes is made as follows: They consist of alternating layers of electrolytic copper and carbon; they are then treated at a high temperature in a furnace under very high pressure until both substances form a uniform solid unit without change of the structure of the metal. No special binding material is used. The brushes are hard like stone. Both types of brushes can be used with 50 to 60 amp. per sq. cm. without causing too high a temperature. For short times this current density may be considerably increased. The resistance of the brushes is only slightly greater than that of pure metal brushes.—*Elek. Neu. Anz.*, March 15.

LIGHTS AND LIGHTING.

Luminous Efficiency of the Carbon Filament.—MENDENHALL.—An account of experiments in which he found that the luminous efficiency of an incandescent lamp filament of normal brilliancy is about 2.6 per cent. The black body temperature of the normal filament is about 2,150° absolute, which is undoubtedly somewhat higher than its actual temperature on account of its selective emission.—*Phys. Rev.*, March.

Nernst Lamp.—WALTON.—A communication on the life of direct-current, 220-volt Nernst lamps (of German make) in the municipal lighting system of Gloucester. From June, 1903, to March, 1905, nine lamps of the older type were in use with 200-volt burners and 30-volt resistances. The average life of the burner was 816.2 hours. In a later installation the new U-type of burners was used and the average life of 30 lamps (from October, 1904, to March, 1905) was only 94.3 hours.—Lond. *Elec.*, March 17.

Train Lighting.—DE VALVREUZE.—The first part of a summary of new proposals made during the last year for electric lighting of railway trains. He first discusses the Hill system, in which the lighting is supplied by storage batteries only. He then deals with the systems of Pieper and l'Hoest, Voigt and Haeffner, Pollak, in which several cars are lighted by means of a single dynamo and several batteries. He then passes over to the discussion of those systems in which each car has its own dynamo and battery, the systems of Schaefer, Aichele, Loppe being discussed. The article is to be concluded.—*L'Eclairage Elec.*, March 11.

POWER.

Electric Power Distribution.—BELL.—An article on some economic aspects of electric power distribution, dealing more with the effect upon "the growth of mankind and the evolution of a sounder society" than on the direct saving in money. The author points out that "a country consisting mainly of large cities with merely incidental rural population has taken a long step toward final disintegration," and that every step toward further concentration of industry and population makes it worse. He dwells especially on the fact that in one particular the present working of hydraulic power is very faulty; that is, that in spite of the great growth of electric power transmission its effect on the consumption of fuel has thus far been very small, owing to the fact that the great mass of hydraulic power, which is in small units, has practically not been touched at all. Of our total water power, probably four-fifths is in falls below 1,000 hp in capacity, and at the present time money can rarely be found for the development of small enterprises of this kind. The author points out that the effect of cheap electric power in encouraging and conserving small industries has already been well demonstrated, particularly abroad. The manufactures which can profitably be carried on in small places having cheap power available are especially those in which the value of the finished product is due mainly to the expenditure of power and labor, in particular highly skilled labor. There are to-day many unutilized powers ranging from 200 to 500 hp that can be acquired and developed, including an electric transmission of moderate length, for about $100 per hp delivered. They are cheap simply because they are on rather small streams in places where at present there is small demand for power. The author then speaks on uniting into a network several available powers of a considerable region. This is the basic principle of some very considerable systems and applies with equal force to smaller ones. The author emphasizes the importance of the upbuilding and maintaining of local industries against the inroads of centralization.—*Eng'ing Mag.*, April.

Blast Furnace Gas for Electric Power Generation.—An article giving the diagram reproduced in Fig. 3, illustrating very clearly the

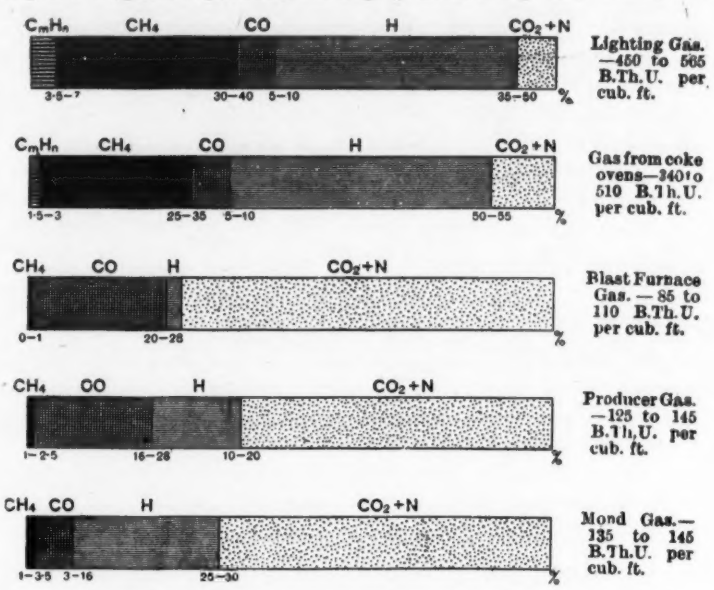


FIG. 3.—DIAGRAM OF COMPOSITION OF GASES.

composition of various gases with respect to their calorific value. A description is given of one of the large German generating stations in which the motive power is supplied by gas engines using the waste gases from the blast furnaces. This is the Phoenix Iron & Steel Works in Laar, near Ruhrort. It is claimed that every brake horse-power-hour produced by the engines corresponds to an expenditure of from only 8,700 to 10,300 B.T.U. The dynamos driven by these gas engines generate three-phase current at 2,000 volts and 47 periods per second. They work in parallel and supply electricity for power, and light to the various parts of the works, where the pressure is reduced to 200 volts by transformers. A 1,200-hp motor (capable of withstanding 50 per cent. overload) is being installed in addition for driving the rolling mills. It will be supplied with current directly from the 2,000-volt mains, and will run at 130 r.p.m. at full load. The motor is directly-coupled to the finishing rolls, but drives the roughing-down mill by ropes. The rolls, which produce light mining rails, sleepers, angle iron and joists of all descriptions, from blooms weighing 800 pounds to 2,200 pounds, and of 8 sq. in. section, consist of roughing-down rolls and one finishing train.—Lond. *Elec.*, March 17.

Electric Power from Blast Furnace Gases.—ROSSI.—The first part of an article on the utilization of the waste gases of blast furnaces in the production of electrical energy, with special reference to the application of the energy to electric furnace work.—*Electrochem. and Met. Ind.*, April.

Synchronizing Electromagnetic Brake.—ABRAHAM.—A French Academy paper on a synchronizing device. The apparatus to be driven is moved by an auxiliary motor. The axle of the motor is provided with a toothed wheel of copper, the teeth of which pass through the air-gap of an electromagnet, its poles being on the two sides of the wheel. This electromagnet is energized by the alternating current to which the motor is to be synchronized. Suppose that synchronism has been established and that each tooth passes through the air-gap in the moment when the magnetic field is zero. The induced currents are then very small and the braking effect which they produce is, therefore, a minimum. In order to maintain the synchronism thus established it would be sufficient for the power supplied to the auxiliary motor to be just such as to produce the movement and to compensate for the small quantity of energy absorbed by the brake. If we now supply to the motor a slightly higher power, the motor will somewhat advance in phase before the alternating current. The teeth of the copper wheel will then pass through the air-gap at moments at which the magnetic field has already a considerable value, so that the induced currents will be increased and the brake will absorb the total supplementary energy of the motor without any increase of the speed. In practice the whole

operation is to allow the motor to run and supply the alternating current to the electromagnet. Synchronism will then be reached spontaneously.—*L'Industrie Elec.*, February 25.

Power Plant in Missouri.—An illustrated description of an electric power transmission in the Missouri lead mining districts. The water power plant is located at Lowell, Kan., and has a normal output of 4,000 hp, but 5,000 hp can be furnished if required. There are two 1,500-kw, 2,300-volt alternating-current generators. For transmission the voltage is raised to 33,000. The transmission line is 28 miles long. There are four sub-stations at which the voltage is stepped down to 2,300, the current being delivered to the customers at this pressure. The full line voltage is impressed directly on all motors of over 50 hp capacity. The smaller motors are wound for 220 or 440 volts. The design of the water power plant represents a radical departure from common practice. The power house is located in the center of the river and forms a part of the concrete dam. The two turbine rooms flank the power house on either side and are also built in and made a part of the dam.—*Eng'ing News*, March 30.

Machine Tool Works.—A fully illustrated description of the up-to-date plant of the Ridgway Machine Tool Company. One special feature is the elaborate crane system employed. The heavy tools are all electrically driven by direct-connected motors and furnish several examples of the latest developments in variable-speed motor drives. The power plant consists of one 150-kw, steam-driven generator. From the switchboard three separate distributing circuits lead, one for the shop motors, one for cranes and the other for lighting. A two-wire system of 240 volts is employed throughout the plant.—*Iron Age*, March 30.

Traction.

Belfast.—A note on the conversion of the Belfast municipal horse tramways to electric operation. The system includes 40 miles of double track. There will be used a centre-running trolley with swivel head, and ordinary double-deck cars without top covers. In order to supply the tramway load large extensions are being carried out in the power station. At present the station contains seven 400-kw sets, two 200-kw sets and two 100-kw sets; there is also a 10-kw booster-balancer set at a 25-kw balancer, the field magnets of which have series fields, so that the drop in the middle wire is automatically allowed for. In the additional plant there will be three 1,000-kw sets, the engines for which will be high-speed vertical machines. A steam consumption guarantee has been given of 16¾ pounds of steam per hp-hour at 170 pounds pressure with 25-in. vacuum, the steam being superheated to 550° F. The speed of the sets is 180 r.p.m. Reciprocating engines were chosen in this case in preference to steam turbines, owing to the fact that the turbine builders would not definitely guarantee so low a steam consumption as the above under like conditions. Current will be supplied directly to the line at 500 volts in the first instance, but a rotary converter sub-station is to be provided at the end of one of the present routes, the intention being to transmit three-phase current to it at a higher voltage, in view of the probability of further extensions at greater distances from the center.—Lond. *Elec.*, March 17.

Electric Automobiles.—Groddeck.—A review of the electrical exhibits of the International Automobile Exposition in Berlin. Concerning the electric automobiles of the Cologne Accumulator Works of Gattfried Hagen it is said that the older lead accumulators for automobiles of this firm give 20 watt-hours per kg. An automobile for four passengers weighs 1,500 kg., the passengers 400 kg., and the battery of 1,700 watt-hours 850 kg.; hence, the total weight is 2.75 tons for a single run of 80 km. without recharging, on the basis of the consumption of 75 watt-hours per ton-km. on a level road. The newer lead accumulators of the same firm give 29 watt-hours per kg. For the same automobile as before one gets a single run of 120 km. without recharging. On the other hand, if one is satisfied with a single run of 80 km., the total weight of the automobile may be reduced by 350 kg. With the very latest type of this firm it is said that 34 watt-hours are obtained per kg. The lower weight of the newer types is obtained by the use of a very thin plate, which is stated to be protected against buckling by mechanical means. The increase of capacity is obtained at the expense of life. While older batteries give 150 discharges before they have to be renewed, the newer ones give only 100 discharges. It is stated, however, that this company has found by experiments extended over several years that this shorter life is not prohibitive, since the increase of cost of maintenance of the battery is smaller than the decrease of cost of maintenance of the rubber tires. Some details are given on mechanical construction of automobiles and on "benzine-dynamo electromobiles." Gottfried Hagen had also exhibited a Jungner battery which, however, is still in the experimental stage and has not been so developed that it can be used in practice. The firm states that this battery is more expensive than the lead accumulator, and that the length of run obtained is not as great as with lead accumulators. Some electromobiles exhibited by Ziegenberg were equipped with lead-zinc accumulators which are claimed to give 50 to 70 watt-hours per kg., and to have an unlimited life, while the time of charging is only one-half hour. No further details are given.—*Elek. Zeit.*, March 2.

Installations, Systems and Appliances.

Paris.—The technical commission for considering the future electricity supply in Paris finished its work in a recent session, when the report of Picou was approved. This report will serve as a basis for the discussions before the Municipal Council of the city of Paris. The report is printed in full. Its main conclusions are that the most suitable system of supply would consist in the production of high-tension polyphase currents with a frequency of 50 periods per second in various generating plants outside of the city near the river Seine; this current to be transformed in sub-stations of which those which supply current to the central districts distribute direct current by a three-wire system at 2 × 110 volts, while from other sub-stations supplying current to the less crowded districts alternating current at 110 volts is to be distributed. For special power purposes the current will be transformed directly at the consumers' premises. "The tariff of charging which appears to be the only logical one is based on the adoption of a formula so that the payment received from the consumer should be as nearly proportional as possible to the expense made for him."—*L'Industrie Elec.*, February 25.

Winterthur.—Herzog.—A fully illustrated description of the municipal electric plant of Winterthur, in Switzerland, which is supplied in bulk with three-phase current at 25,000 volts and 50 periods per second from another works, the voltage being stepped down to 300 by stationary transformers. In the station the three-phase currents are then changed into direct current to supply a three-wire system of 2 × 220 volts, with a bare earthed middle wire. The voltage is divided by means of a battery. There are two three-phase induction-motor, direct-current generator sets, each of 365 hp, for supplying the lighting current, while a three-phase synchronous-motor, direct-current generator of 200 hp supplies current for traction. There is also provided a booster for charging a battery which consists of 260 cells, having a capacity of 864 or 1,160 amp.-hours for a three-hour or ten-hour discharge, respectively.—*Zeit. f. Elek.* (Vienna), Mch. 12.

Wires, Wiring and Conduits.

Protecting Inside Conductors Against Dust.—Hiecke.—An article stating that insulated electric conductors which are not otherwise protected inside of buildings are often covered with a large amount of dust. This is due to a potential difference of the conductor against earth which produces a static charge on the surface of the insulating layer. To prevent this it is sufficient to wind around the insulating material a long helix of a bare wire which need not be directly earthed, but may be connected to earth through a resistance of 3,000 to 5,000 ohms. This remedy, which is used by an Austrian company in all of its installations, is said to have proven entirely successful.—*Zeit. f. Elek.* (Vienna), March 12.

Telephone and Telegraph Cables.—Schmidt.—An illustrated article on the methods of avoiding induction in telephone and telegraph cables. He discusses especially those methods which are based on special arrangements of the position of the various conductors in the cable.—*Zeit. f. Elek.* (Vienna), March 19.

Electrophysics and Magnetism.

Effect of Pressure on Selenium Cells.—Brown.—An American Physical Society paper. The author investigated the conductivity of several selenium cells under pressure as high as 600 atmospheres. The cells were kept in a receiver packed in ice. For pressures amounting to 218, 100, 0 kg. per sq. cm. the resistance of one cell was found to be 63,900, 79,790 and 96,000 ohms, respectively. The effect of pressure is thus as remarkable as the effect of heat and light on the conductivity.—*Phys. Rev.*, March.

Thermoelectric Coefficient in Soft Iron.—HALL.—An American Physical Society paper on the direct measurement on the Thomson thermoelectric coefficient in soft iron. This coefficient is the factor by which the absolute temperature of the metal at any section must be multiplied in order to find the amount of heat reversibly generated or absorbed per second by one ampere flowing at the section considered between points differing from each other one Centigrade degree in temperature. Attempts at direct measurements of this coefficient in any metals have been few, as the Thomson effect is small and difficult to measure. Battelli, in experiments with iron, got for the coefficient the value 32×10^{-6}, while Hall now finds a value of 76×10^{-6}, more than twice as great as that found by Battelli. —*Phys. Rev.*, March.

Electrodeless Discharge.—DAVIS.—An account of experiments on the white electrodeless ring discharge in gases. The author determined the minimum electric intensity in volts per centimeter, acting around the vessel, which was just necessary to start the white discharge at various pressures. His experiments show the existence of a minimum discharge potential for each case occurring at a certain pressure. This minimum pressure and potential he refers to as the critical point. The critical point depends upon the frequency of oscillation of the Leyden jar system. The starting electric intensity depends on the frequency of oscillation for all pressures below the critical point, but is independent of the frequency for all pressures above the critical point. Some theoretical considerations concerning the explanation of the phenomena on the basis of the electronic hypothesis are added.—*Phys. Rev.*, March.

Magnetic Susceptibility of Water.—WILLS.—An American Physical Society paper in which he determined by a new method the magnetic susceptibility of water with varying magnetic fields. For a magnetic field varying between 4,190 and 15,310 c.g.s. units the coefficient of magnetic susceptibility was practically constant, being equal to -0.72×10^{-6}.—*Phys. Rev.*, March.

ELECTROCHEMISTRY AND BATTERIES.

Electric Furnace.—FITZ GERALD.—A fully illustrated description of the construction of an electric muffle furnace. The muffles are embedded in a granular resistance material through which the current passes. Various instructive experiments are described in which special attention is paid to proper thermal insulation of the furnace. Details are given as to the erection of such a furnace.—*Electrochem. and Met. Ind.*, April.

Electrometallurgy of Iron and Steel.—HARBORD.—The first part of an illustrated Faraday Society paper on recent developments in electric smelting in connection with iron and steel. The paper is essentially a resumé of the work of the Canadian Commission which studied electric steel furnaces in Europe last year, and of which the author was the metallurgist.—Lond. *Elec.*, March 17.

Thermochemistry.—RICHARDS.—The second installment of his serial on metallurgical calculations. The author has compiled the most important thermochemical data required by metallurgists. They are conveniently arranged in form of tables.—*Electrochem. and Met. Ind.*, April.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Comparison of Inductances.—TAYLOR.—A description of a method enabling the comparison of inductances with great precision. It is somewhat similar to the potentiometer method, although it necessarily involves the idea of phase displacement. The first step of his experiments was to send an alternating current, i_1, through a non-inductive resistance, r_1, and a second alternating current, i_2, through a non-inductive resistance, r_2, and balance the potential difference, $i_1 r_1$, against $i_2 r_2$. This is possible only if i_1 and i_2 come from separate coils on the same transformer, and it was found necessary that the two coils furnishing i_1 and i_2 were braided together and formed a bifilar winding. As shown in Fig. 4, P is the primary of the transformer, in series with a large choke coil. S_1 and S_2 are the two secondaries which are really braided and thus wound on the transformer core. The transformer is placed several meters from the rest of the circuit, and S_1 and S_2 are connected to their respective circuits with braided leads. At x_1 and x_2 are variable reactances for shifting the phase of the two circuits, while r_1 and r_2 are two non-inductive standards whose ratio was accurately determined by an Elliott bridge. S is a standard of self-induction, variable up to 40 milli-henrys, and L is the inductance to be compared. Both of these inductances were located several meters away from the rest of the circuit, and connected to it by braided leads. The stray magnetic field from the standard inductance is particularly annoying in preventing a perfect balance. At l_1 and l_2 are amalgamated copper links, dipping into mercury cups, and cutting out S and L, respectively. Extending beyond l_1 and l_2 are two pairs of I. A. alloy wires, one pair for each circuit, arranged so that more or less can be cut

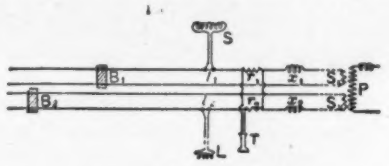


FIG. 4.—COMPARISON OF INDUCTANCES.

out by sliding the bridges, B_1 and B_2, thus forming smoothly variable rheostats for controlling the current in the two circuits. The method of operation is first to obtain a balance with l_1 and l_2 in place. The sliders, B_1 and B_2, are moved so that the telephone indicates a minimum, and then the circuits are shifted into phase by varying x_1 and x_2. These two adjustments are readily made simultaneously. This adjustment is usually preliminary, so as to determine what ranges are necessary for x_1 and x_2. The link, l_1, is now removed and the adjustment repeated with the smallest convenient setting of S. Finally l_2 is removed, and a balance obtained by sliding B_1 and B_2 and increasing S, the reactance, x_1 and x_2, being left undisturbed. If ΔS is the change in the reading of the standard, the inductance to be determined is $L = \Delta S \frac{r_2}{r_1}$. The value of L may be obtained with a single setting of S by omitting the second adjustment, in which case S is the setting of the standard in the final adjustment. Thus, L may be determined in terms of one value of the standard or in terms of the difference of two values of S taken in different parts of the scale.—*Phys. Rev.*, March.

Integrating Thermometer.—FERY.—A French Academy paper on an integrating thermometer. The arrangement is shown in Fig. 5. On the axle, $A\ B$, is mounted a wheel, r, and this axle can be dis-

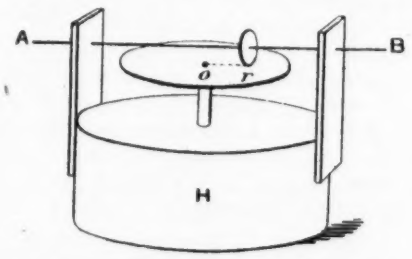


FIG. 5.—INTEGRATING THERMOMETER.

placed longitudinally by means of a metallic thermometer (which is not shown in the figure) in such a way that the distance, $o\ r$, of the little wheel from the centre, o, of the disc with which it is in contact is proportional to the temperature. The disc, o, is itself revolved by means of the clockwork, H. The number of revolutions of the small wheel is registered, and at regular intervals the disc is lowered in order to permit the little wheel to assume its correct position. This eliminates the errors which could result from the friction of the wheel along the radius, $o\ r$. The number of revolutions of the small wheel per unit of time is proportional to the main temperature. The apparatus has been tested by means of an Ostwald regulator, which maintains the temperature constant as long as it is desired; the curve which represents the number of revolutions as a function of the temperature is strictly a straight line.—*L'Industrie Elec.*, Feb. 25.

Insulation Measurements.—REVILLIOD.—A paper on insulation measurements by means of the method of the loss of charge. This method is very practical, but the theory and formulas are generally developed as though the insulation resistance was constant while experience shows that this resistance varies not only with the duration of electrification, but also with the voltage. The author develops the theory and the formulas to be applies, taking account of the variation of the insulation resistance with the time and voltage.—*L'Eclairage Elec.*, March 11.

Miscellaneous.

Blaze Currents.—Mrs. Waller.—An account of a continuation of her husband's work on the electrical responses to stimulation exhibited by animal and vegetable tissues, which responses he has designated "blaze currents." These response currents may be either in the direction of the stimulating current (homodrome) or in the opposite direction (antidromo).—Lond. *Elec.*, Feb. 24; from *Royal Society* paper read Jan. 26.

BOOK REVIEWS.

Short Course in Alternating-Current Testing. By Fitzhugh Townsend. New York: D. Van Nostrand Co. 32 pages, 10 illustrations. Price, 75 cents.

In this pamphlet are given outlines of a number of commercial tests on alternating-current machinery. After a few introductory remarks on the properties of circuits, the operation characteristics of generators, transformers, motors and rotary converters are discussed. The characteristic feature of the treatment is brevity, and the author has succeeded in including much of value in the 32 pages devoted to the pamphlet.

The Telephone Service. By Herbert Laws Webb. London: Whittaker & Co. 118 pages, 6 illustrations. Price, 1 shilling.

The book describes in popular terms the general features of a modern city telephone system, and while it contains little of strictly technical information, and is not intended to be used as a text or for reference by the engineer, one can obtain from its pages a good operating knowledge of the telephone. It is, in short, designed for the general reader interested in the working and development of the telephone. Such a one will lay aside the book with a feeling that the time spent in perusing its contents has been profitably employed, and he will find himself more in sympathy with the human portion of the telephone machinery. Mr. Webb's literary work is always admirable, sane and trustworthy.

Ferric and Heliographic Processes. A Handbook for Photographers, Draughtsmen and Sun Printers. Second Edition. By George E. Brown. New York: Tennant & Ward. 149 pages, 29 illustrations. Price, $1.00.

This little volume deals with the iron printing processes and their practical uses. Although the proper proportions of the chemicals to be used in each process are indicated, all theory relating thereto has been omitted, the aim of the book being to be strictly practical. While numerous other processes are treated briefly, the greater prominence is given to the ferro-prussate (blue), ferric oxalate and silver nitrate (brown), ferric and cupric chlorides (greenish-black) and ferro-gallic (black). For the purpose of showing the result to be expected from the various processes, there are inserted in the book samples of the more prominent prints. Complete instructions are given both as to the use of the sensitive papers and as to their initial preparation.

Notices sur L'Électricité. Électricité Statique et Dynamique. Production et Transport de l'energie Électrique. Par A. Cornu. Paris: Gauthier-Villars. 275 pages, 37 illustrations. Price, 5 francs.

Alfred Cornu was not only a leader in science, but also a masterly expounder of his favorite subjects—light and electricity. With the era of electric lighting and electric industries, came a demand for a somewhat popular explanation of the new nomenclature and the scientific principles involved in the measurement of power, polyphase currents and the like. It was to meet this demand of many of his countrymen and former students that Prof. Cornu began a series of articles in the *Annuaire du Bureau des Longitudes* in 1893. This yearly publication is a valuable but unpretentious sort of a nautical almanac which, in addition to matters of astronomical interest, contains various tables of constants and papers on physical subjects. Prior to Prof. Cornu, we find such contributors to the *Annuaire* as Arago, Delaunay, Faye and Tisserand.

In his first "Notices," extending from 1893 to 1896, Prof. Cornu sought to correlate the phenomena of static and dynamic electricity, to define the fundamental and derived units, and to explain the generation and properties of continuous currents, whilst in 1900, 1901 and 1902 he dealt at considerable length with polyphase currents and the electrical transmission of energy.

The last chapter of the present volume is entitled "Le transport Electrique de la Force," though the author takes great pains to show that the entity conveyed is not force but energy. On page 78, we read that Faraday made his great discovery of magneto-induction in 1839, evidently a clerical error for 1831. The induction coil is accredited to Masson and Breguet in 1842, the condenser being introduced by Fizeau in 1853.

Students of electrical theory will be grateful to the editors of the present volume for having collected from the *Annuaire* papers of so much permanent interest, written by a man of whom it was said that he had a marvelous talent for bringing the most abstruse conceptions within the comprehension of the ordinary reader. The present volume amply justifies the words of the panegyrist.

Electric Traction. By John H. Rider. London: Whittaker & Co. 453 pages, 194 illustrations. Price, 10 shillings and sixpence.

The author in this work has confined his treatment to descriptive matter almost entirely, and has included very little that is strictly theoretical. After dealing with the general features of the dynamos and motors, the distributing circuits, rolling stock and the roadbed, the various overhead, conduit, surface-contact and accumulator systems are described in detail.

Although the author has apparently had considerable experience with practice in England and is evidently quite familiar with English methods, features of construction or operation which are found only in America, are properly covered. As should be expected, no attempt is made to give to the alternating-current systems more than a mere mention. It is strange that one evidently thoroughly conversant with direct-current machinery should allow to appear in the book, when outlining the performance of the induction motor, the statement: "If the fields of a direct-current motor were fully excited, and were rotated at full speed, while the armature was held at rest, a large current would be induced in the armature coils." The Ward Leonard single-phase motor-generator motor system and the Lamme single-phase motor system are cited as examples of possible solutions of the single-phase, alternating-current railway problem.

Durability of Steam Turbine Vanes With Special Reference to the Westinghouse-Parsons Type.

We have received from the Westinghouse Machine Company the following communication, which forms an interesting contribution to the constructional side of steam turbine engineering:

To the Editors of Electrical World and Engineer:

Sirs:—There has recently been brought to our attention from numerous sources a report upon the alleged short life of the vanes in steam turbines, stated to have been inspired by an European engine builder. The sole evidence rests upon photographs of turbine vanes purported to have worn out with less than one year's service. This report bears all the earmarks of misinformation, if not of malicious

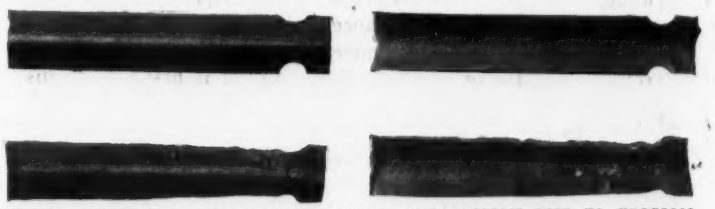


FIG. I.—EXHIBIT I. SHOWING DAMAGE APPARENTLY DUE TO EROSION.

falsehood, especially as similar photographs have been covertly circulated in this country as representing the experience in various American turbine plants. We, therefore, ask the courtesy of your columns for a brief statement of facts, and are content to leave to the good judgment of your readers the conclusions to be drawn therefrom.

The text of our argument we find in the following passage: "As to the cost of maintenance and repairs, it is claimed that there is an enormous wear (meaning erosion) in the back of the turbine blades * * * * * * *." Photographs of both convex and con-

cave sides of a new and a damaged vane are shown. From a careful examination of these photographs we conclude, first, that the supposed erosion is probably due entirely to an accident in which the blade in question had been badly damaged by the flying particles, but not entirely broken off; or, second, that a new blade had been deliberately injured for illustrative purposes; or, third, that it has been in a class of service, the severity of which we have no conception.

The photographs in question show that both edges of the blade

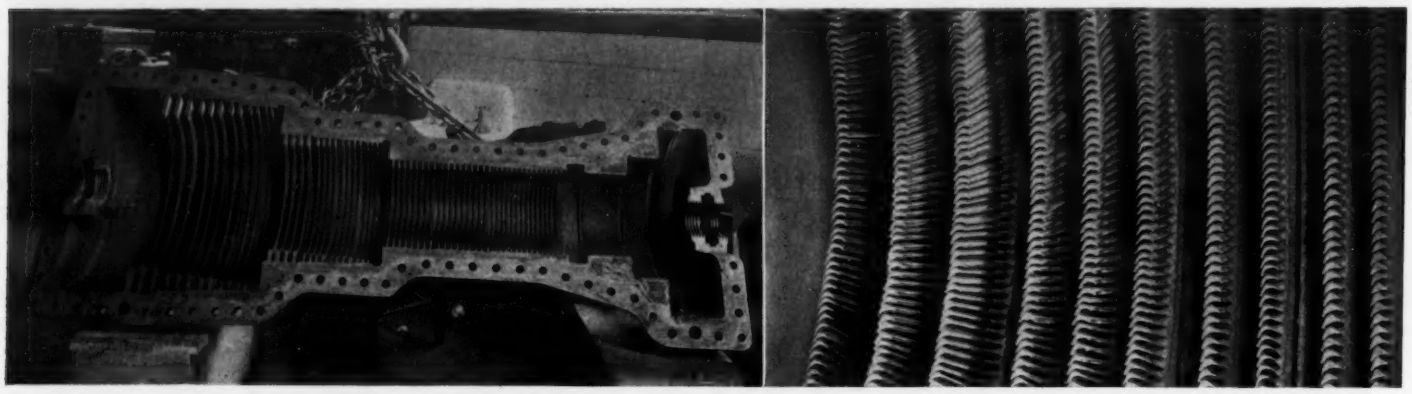


FIG. 2.—EXHIBIT 2A AND 2B. INTERIOR OF UPPER HALF OF STATOR.

have been curled over, so that in the position in which the photograph is taken a considerable portion of metal appears to have been eaten away. There is also conspicuous evidence of the indentations of a round-nosed instrument on one of the damaged edges and of a chisel upon the other. Such injury is manifestly not due to normal wear, as the innocent-looking title would lead one to believe: "Same bucket after having been *in use* less than one year."

A skillful photographer can, by adjusting lights, shades and focus, create most convincing effects. To illustrate, we have photographed a turbine blade, Exhibit I, which was taken out of an experimental machine in which several rows of vanes had been damaged, due to accidental distortion of the casing. This photograph bears a striking resemblance to those referred to above and shows how easily a false impression may be created. You will observe that this blade bears strong evidence of erosion upon the back (Fig. 1A), whereas it was in fact a new vane damaged in the manner shown simply by bombardment of small broken particles of other vanes. If the photograph had been taken slightly out of focus the edge shown curled over in Fig. 1B would have appeared to be badly eaten away. The concave surface is of course intact.

In support of our contention that steam erosion in the Parsons

been in continuous service upon a 24-hour factory load. Fig. 2A shows the upper half of the stator; Fig. 3A the upper half of the rotor; Figs. 2B and 3B closer views of stator and rotor, respectively. In the last two views a position was chosen looking directly along the cutting edges of the vanes to show their condition after over five years' continuous service.

In order to exhibit this still more clearly in detail, two vanes were deliberately broken out of the eighth and twelfth rows, respectively, of the low-pressure barrel where the greatest quantity of moisture occurs, and where erosion would, if at all, be expected. These are shown in Exhibits 4 and 5. Although reproduced as sharply as possible, the old vanes are even in better condition than they appear, and their metallic surfaces have retained the original polish of new vanes as they come from the drawing machine. Exhibit 6 shows

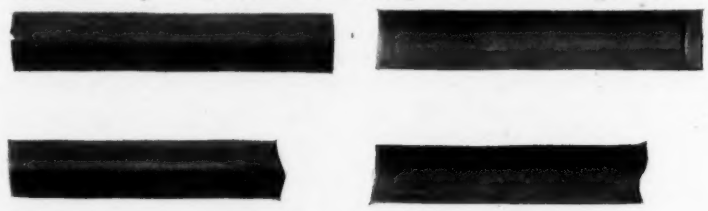


FIG. 4.—EXHIBIT 4. VANE AFTER OVER 5½ YEARS' CONTINUOUS SERVICE.

one of these specimens set on edge alongside of a new vane of similar size. The end of the new vane appears rough, as it has been sheared off and not ground true, as would be the case when finally inserted in a finished machine.

Three facts must be apparent from these photographs: First, that the old vane has retained its full cross-section, and hence its full

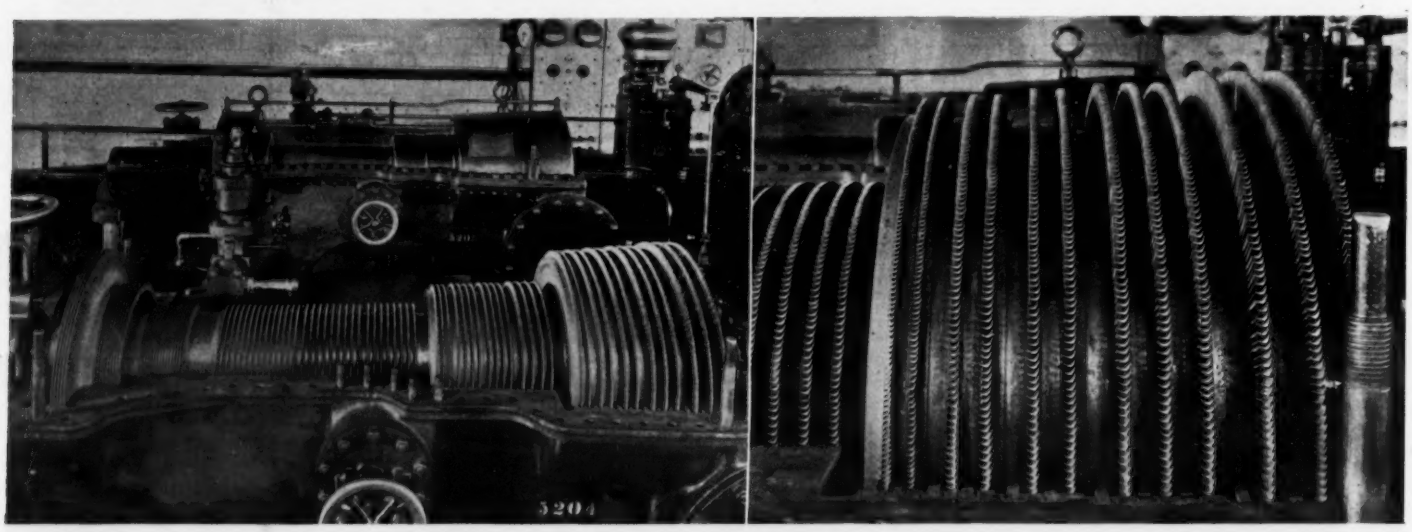


FIG. 3.—EXHIBIT 3A AND 3B. ROTOR OF 400-KW. TURBINE.

type of turbine is quite negligible, owing to the low steam velocities employed, we have recently photographed the interior of the first steam turbine put into practical use in America and the first turbine built by us for commercial service. This machine was installed in 1899, and together with the three units installed soon after has since

mechanical strength; second, that the vane angles and hence the efficiency are unimpaired in service; third, that the surfaces along which the working steam passes have not lost their original smoothness.

The only effect traceable to steam wear on the vanes of this

turbine is to be found in the case of vanes which have been set slightly out of line with the remaining ones of their particular ring. In such cases the area projecting into the steam space becomes slightly scored on the advancing side, presumably due to their contact with particles of moisture coursing through the lower stages of the turbine during light loads when their velocity in this region is probably somewhat less than normal. This effect, however, but occasionally develops and simply results in the sharpening of the cutting edges of the vane to such fineness that a piece of heavy cord may readily be severed. In no case has the section of metal been

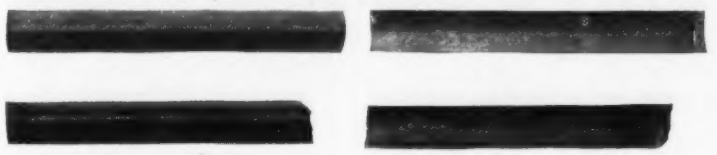


FIG. 5.—EXHIBIT 5. VANE OF TWELFTH ROW LOW-PRESSURE BARREL.

worn away to any appreciable extent. The vane reproduced in Fig. 4 was slightly out of line and shows this effect as much as any other in the turbine.

In judging the results obtained from this turbine it should be borne in mind that the steam supply has always been excessively wet, owing partly to a long run of steam piping. No superheaters are used. On several occasions the turbines have been checked considerably below their normal speed from the effects of slugs of water passing through them. It also frequently occurs that creek water has to be put into the boilers owing to the failure of city water supply. This water is at all times extremely acid and very impure. In fact, it has been necessary to coat the outer surface of the dummy pistons with white lead to prevent their corrosion from this acid water.

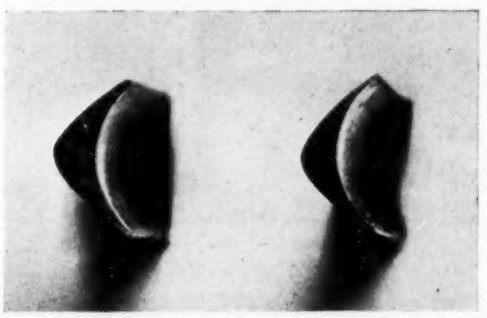


FIG. 6.—EXHIBIT 6. SECTION OF VANE IN CONTINUOUS USE SINCE 1899.

Owing to the accumulation of sediment, the turbines have to be frequently cleaned by air blast, as the steam velocities are not sufficient to keep the passages clear.

In conclusion it should be recalled that the turbine on exhibit represents the beginning of the present turbine industry in America. Its failure would have been even more conspicuous than has been its success. It is, therefore, reasonable to suppose that improved methods of manufacture and increased understanding of the turbine art should have resulted in an improved machine rather than the reverse, as our detractors would have you believe.

PITTSBURG, PA. THE WESTINGHOUSE MACHINE COMPANY.

Morse Automatic Printer.

A novel receiving telegraph instrument recently developed prints Morse messages in English or other characters on a strip of tape, in a similar manner to the familiar "Stock Ticker." It is, however, unlike any other machine of the kind, in that no special apparatus is required for sending the messages, the regular Morse key, in the hands of an ordinarily skilled Morse operator, only being employed.

Receiving printing telegraph instruments heretofore devised have depended upon some synchronizing device to keep the sending and receiving instruments in unison, with the exception of that class of apparatus which depends upon variable strengths and direction of current in the line. In the instrument illustrated there are no vibrating reeds or other highly sensitive parts, and the mechanism is comparatively simple.

The instrument operates on the principle of analysis and synthesis, the analytical portion measuring the length of the impulses, as well as their respective positions in the character being sent over the line, and the synthetic portion turning the typewheel to the position corresponding to the value of the combination of impulses representing that character. Should one character be missent, it will have no influence over the following character, as the entire mechanism starts from zero for each character. An interesting feature of the invention is that it may be almost instantly attached to any Morse telegraph line, and the messages will then be printed in English on the tape, instead of being recorded in the form of dots and dashes, or being received by ear and translated by the operator,

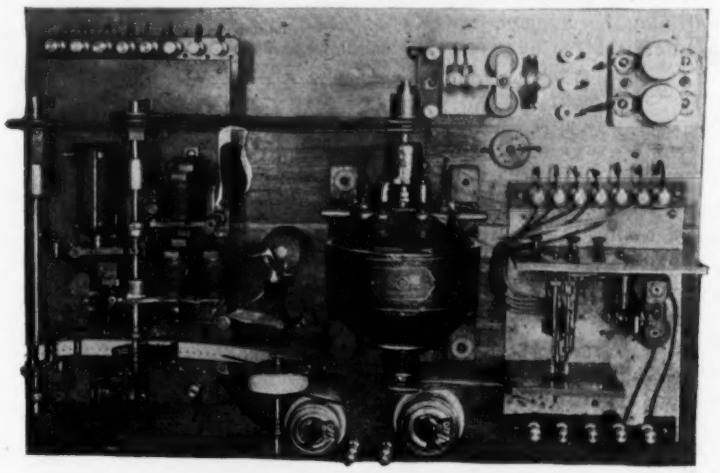


FIG. 1.—AUTOMATIC PRINTER.

and at the same time the regular Morse instruments will operate as usual, since the line conditions have not been disturbed.

The instrument in Fig. 1, when connected in the local circuit of a wireless telegraph outfit, recorded the wireless messages in printed English, a feat perhaps never before accomplished. The instrument in Fig. 2 is a more recent type than that shown in Fig. 1, and

FIG. 2.—AUTOMATIC PRINTER.

is also much more rapid in operation. The machine has given excellent results when connected on a line with the well-known Morse transmitting typewriter.

It is obvious that this machine should go a great way toward solving the problem of rapid and accurate commercial telegraphy, as the change may be made gradually from manual to automatic transmission without changing the line or office equipment, a feature which should not be lost sight of. As an example, it has been possible for an ordinarily skilled typewritist to send Morse messages with a Morse transmitting typewriter, the message being legible to a skilled Morse operator at the other end of the

line. By the introduction of this new receiving instrument the skilled operator could send messages to the typewritist, the translating instrument automatically receiving and translating the Morse characters, and printing their corresponding English characters on tape or page. It would, therefore, be possible for a person wholly unfamiliar with the Morse code, to communicate with a skilled Morse operator, the only modification of line or office equipment being in the improved instruments used by the person not familiar with the Morse code.

There are many other uses to which the principle of this invention may be applied, notably for selective signaling, etc. The inventor is Mr. Charles R. Underhill.

New Line of Alternating-Current Apparatus.

In view of the increasing use of alternating currents and of the induction motor, the American Electric & Controller Company has added to its direct-current work a department devoted entirely to the manufacture of alternating-current appliances and apparatus. Among the former is the switch shown in the accompanying illustration, which can be operated from any point on an alternating-current system of distribution. This switch shown is designed for 100 amp., three-phase. The solenoid is actuated by a push-button or small snap switch which can be located at any distance from the point where the switch is installed. The switch is so designed as to take advantage of the peculiarities of the alternating-current solenoid, at the same time combining simple construction and small solenoid with positive and reliable action.

To users of small induction motors in connection with cistern pumps in hotels, apartments and office buildings, as well as for ventilating systems, etc., this switch will particularly appeal. Another important field for this apparatus is for throwing in and out of one

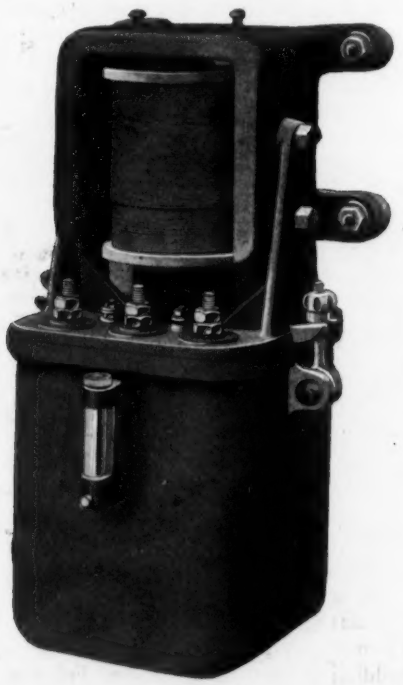


FIG. I.—ALTERNATING-CURRENT SWITCH.

or more transformers where there are several in a bank and which during certain periods of the day would operate on such light loads as to be very inefficient if they were all left in circuit. A solenoid switch placed in the circuit of each transformer enables the operator at the station to throw out as many as the load conditions warrant, or they may be arranged to operate entirely automatically as the load rises or falls.

Still another application is in connection with auto-starters or grid-resistance starters for the control of motors of large size used in connection with ventilating systems, plunger elevator systems, pneumatic tool equipments; in brief, wherever it is desirable either to stop or start a motor from some distant point or automatically, this apparatus is applicable. This switch can be used for synchronizing, as two or more of them can be worked simultaneously from the switchboard regardless of the location of the switch.

Fig. 2 represents an alternating-current system of distribution for both power and lighting where a few of the uses above mentioned are shown in application. By reference to the cut it will be seen

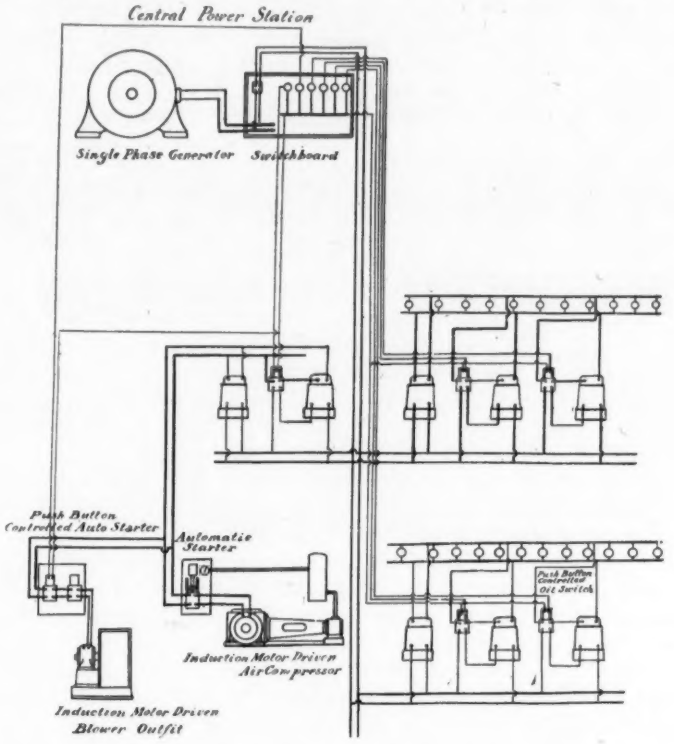
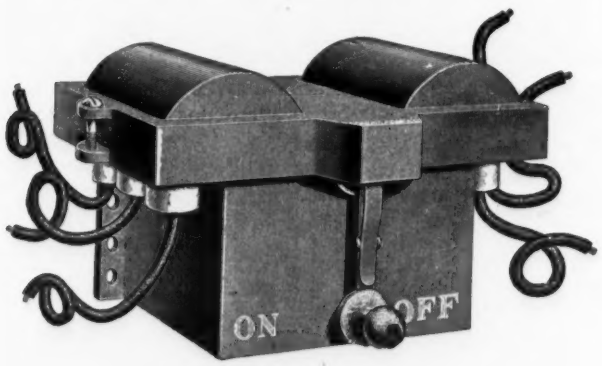


FIG. 2.—DIAGRAM OF ALTERNATING-CURRENT DISTRIBUTION SYSTEM.

that in this particular case all solenoids connected with the control of the apparatus work on the low-potential side of the transformers.

Weatherproof Oil Switches and Cut-Outs.

The growing use of alternating current for light and power systems, with increased potentials and inductive loads, has led to the development of a line of oil switches and cut-outs by the High-Tension Electrical Specialty Company, of Newton, Mass., which are self-contained and adapted for use in damp or exposed locations. These switches have been in commercial use by many of the representative central stations throughout the country for the past few years and have been thoroughly tried out under all conditions. A number of valuable improvements have been gradually made in their construction as a result of experience, and as now constructed are claimed to leave little to be desired to adapt them to all uses.



OIL SWITCH AND CUTOUT.

They are of very robust construction, well adapted to withstand rough handling. Provision is made against oil leakage by capillarity or slopping, and on the smaller sizes locking devices are used to prevent accidental closing by employees working on poles or in manholes. In the larger sizes the friction of movement is generally sufficient to prevent accidental operation. Their field of usefulness is

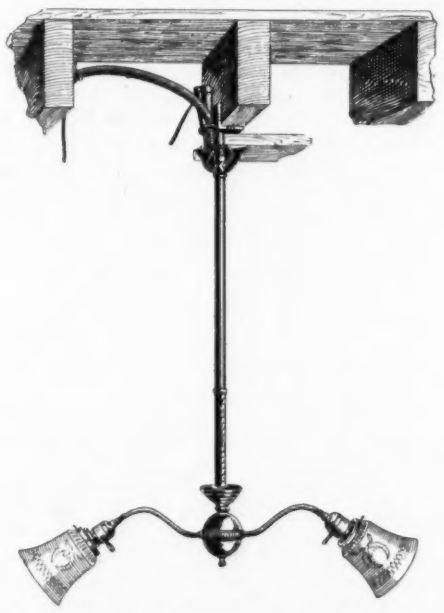
large, and they are successfully employed for all kinds of work, either inductive or non-inductive, such as controlling large transformers, reactive coil of constant-current system of lighting, synchronous or induction motors, isolating portions of feeders or mains, etc. Absolute series cut-outs both automatic and non-automatic operating under oil are also included in this line.

Nuremberg Engines.

The Nuremberg Works, in Germany, desire it to be known that they use for their steam engines a trip valve gear in accordance with their own patents (Marx Gear). For their gas engines they also use their own patent gear, which works as follows: The cut-off of the valve always takes place at the same time, while the valve opens at different periods, i. e., at full load sooner, at small load later. If the engine is entirely unloaded the opening of the valve takes place at such a late period that it coincides with the cut-off, so that the valve remains shut altogether; the opening point only is, therefore, controlled by the governor, while no influence is exercised upon the cut-off mechanism.

Electric Fixture Hanger.

The accompanying illustration shows a new device for supporting electric fixtures, which is being placed on the market by the Lux Electric & Construction Company, of Everett, Washington. It is to be called the "Stay There" hanger, and when screwed to the side of a joist by two screws and to the underside by one screw it is there to stay, and is capable of supporting a weight of from 500 to



ELECTRIC FIXTURE HANGER.

1,000 pounds. It is claimed to be a marked improvement over the old way of hanging a fixture to a crowfoot apt soon to become loose, thereby allowing the fixture to hang out of perpendicular. Figuring the total time of wiring a building for fixture outlets and hanging the fixture afterwards, quite a little time is saved with the new device over the old way.

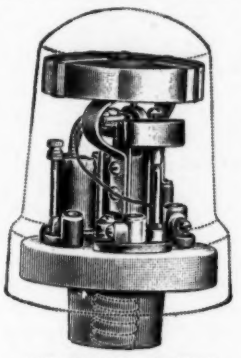
Sturtevant Progress Club.

An interesting organization has just been perfected by those connected with the B. F. Sturtevant Co., of Boston, Mass., its object being to consider questions of engineering and commercial interest, and to increase the mutual acquaintance of the members. Its character is well suggested by its title, The Progress Club. Its membership is open to all, high or low, who are in any way associated with the company. Its membership, however, is classified into seniors and juniors, the former including those who are 21 years of age or over, who have had charge of the work of others, or who have been juniors in regular standing for three years. Control is placed in the council, consisting of president, vice-president, secretary, treasurer and three members at large, whose duty it is to arrange programmes for the meetings, publish and distribute necessary reports of the proceedings, and, in general, to direct the affairs of the club.

It will be a distinct purpose of the club to associate in its membership those in the branch houses and local offices, as well as those connected with the plant at Hyde Park.

Automatic Cut-Out for Series Arc Lamps.

The accompanying illustration shows a form of automatic switch and local lightning arrester designed for use especially with enclosed series arc lamps. The major portion of failures in the case of this type of lamp may be attributed to the excess of duties imposed upon the shunt coils, on account of the variation in the length of the arc of the carbons while burning within the enclosed space. The fumes from the burning arc tend to create on the carbons a deposit which makes them liable to stick. Only the force of the small weight of the moving carbon is available for overcoming the friction. When the carbon ceases to slide freely, the counter voltage across the arc becomes irregular in value with a consequent irregularity in the value of the current in the shunt coils, and considerable pumping is the result. It is evident that if, under these conditions, the mechanism which controls the feeding of the carbon rods also operates the cut-out, the contacts of the cut-out will be closed very frequently.



AUTOMATIC CUTOUT.

The idea which has been embodied in the automatic cut-out now being placed upon the market by A. F. Hamacek, of 2039 Kenmore Avenue, Chicago, involves a mechanism for the cut-out entirely distinct from the feeding magnets. It is found that by this means there is eliminated much of the buzzing of the mechanism due to the intermittent action of the shunt-wound magnets. In operation the automatic cut-out causes the substitution in the circuits of an impedance equivalent to that of the lamp, thereby contributing to the perfect regulation of the whole system. There is provided in the cut-out a small air-gap across which any excess voltage, such as that due to lightning or that attending the opening under load of the inductive circuit, will cause a spark to pass, and the arc thus formed will be extinguished by the automatic cut-out.

Electric Light Plant of County Court House, Chicago.

The electric light plant recently installed in the Cook County Court House, Chicago, replaces a former plant which had become obsolete. The fact that boilers are required for heating such a large building was an argument in favor of combining an electric light plant with this work, since the additional cost of the attendance required is not very great.

The building is lighted by 16 arc lights and 2,300 incandescent lamps. The voltage at the switchboard is 125. The generating machinery consists of one 100-kw and one 150-kw engine-type, six-pole, direct-current generator built by the National Electric Company, Milwaukee, direct-connected to engines of the four-valve, single-cylinder type, the former running at 225 r.p.m. and the latter at 200 r.p.m. The engines are single-cylinder, with double-slide admission valves and Corliss exhaust valves. The pressure of supply steam is 125 pounds per sq. in. The new plant is a great improvement on the former belt-driven installation, there being now no appreciable noise or vibration, which is an important requirement of a plant installed in a public building of this nature. On several occasions the generators have had to carry a steady overload of 20 per cent., which they have done very satisfactorily, without any sparking even for a constant position of the brush holder yoke. The engine room is conveniently located, being in the basement on a level with the street.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Reports of trade are satisfactory, the continued high temperature favoring distribution in all leading lines. The closing days of March brought greater confidence regarding the future, and results for the first quarter of 1905 proved even more favorable than was anticipated when the year opened. Sanguine expectations of manufacturers who made extensive preparations are now being realized. Reports from the South indicate that the period of hesitation is about over and agricultural sections are stimulated by prospects of a good season for planting. Freight congestion has followed the heavy shipment of spring merchandise, and railway earnings in three weeks of March were 8.2 per cent. larger than in 1904. Official returns make the cotton crop fully a third larger than the one preceding, and still prices are far from demoralized. With the subsidence of floods the mills have resumed, water traffic is heavy, and the percentage of unemployed is seasonably reduced. Buyers are arriving in large numbers at the leading jobbing centres. A steady demand is noted in all departments of the iron and steel industry, orders constantly coming forward, and most plants are assured of activity for many months, while some mills decline contracts for shipment any time before 1906. Inquiries for pig iron for distant delivery meet with a demand for about fifty cents more than spot quotations. A considerable purchase by the leading interest is expected during April. The recent large sale of billets improved the tone of the market, despite the fact that the price was not announced. Prospects favor a very early opening of interior navigation, particularly on the great lakes, with an enormous ore trade downward, and a heavy coal business up is foreshadowed. The copper market was very quiet and unchanged. Buyers are only taking small quantities to fill their immediate wants. Lake is quoted at 15¼ to 15⅜c.; electrolytic, 15⅛ to 15¼c.; casting stock, 15⅞ to 15c. The business failures for the week ending March 30, as reported by *Bradstreet's*, number 227, as against 204 the previous week, and 212 the corresponding week last year.

ALLIS-CHALMERS HEAD OFFICES.—The Allis-Chalmers Company is removing its general offices from Chicago to Milwaukee. This is another step in the direction of carrying out the plans of the present administration, which are gradually being brought to completion. One of the first conclusions arrived at by President Warren, after assuming office a year ago, was that for every reason connected with efficient administration of all branches of the work, from designing to manufacturing, and from selling to collecting and accounting, the chief offices of the company, covering all the ramifications of its business, should be concentrated in one place. That place was logically Milwaukee; because, although the company has four other works in three other cities, the largest works are in Milwaukee, and Milwaukee is where all the future expansion of the company's operations will take place. Besides, at the Milwaukee suburb of West Allis it has the land to build upon. Instead of handling the several departments at long range, as under the old system, they will all be concentrated in one place, thus eliminating the necessity for constant traveling to and fro, effecting a great saving in time and expense, an enormous reduction in correspondence and, above all, the quickening of all movements of production. Only by concentration at the strategic point can the results that have been aimed at by the president be accomplished. Plans for the workshop extensions at West Allis, which involve the construction of several more units, are practically complete, and the extensions will be made in due course.

ELECTRIC DEVELOPMENT IN CUBA.—The Compania Electrica de Santiago, of Santiago de Cuba, has been organized with a capital stock of $300,000 and an authorized bond issue of $300,000 additional. Jose Marimon is president, and Eduardo J. Chibas vice-president and managing director. The company operates under a concession given by the president and secretary of government of the republic and a charter granted by the municipality of Santiago de Cuba. The company proposes to build immediately a plant to supply light and power to private consumers and later to construct a street and suburban railway. The following contracts have been let: To the Babcock & Wilcox Company, of New York, for supplying three boilers of 500 horse-power and a steel smokestack 110 feet high; to the Buckeye Engine Company, of Salem, Ohio, for supplying two stationary engines of 235 horse-power each; to the General Electric Company, of New York, for supplying all the electrical machinery necessary for the equipment of the plant.

UNITED TELPHERAGE COMPANY.—In our last issue we made the announcement that the Dodge Coal Storage Company had acquired the business of the United Telpherage Company. We have since received further and authoritative details of the transaction. The United Telpherage Company decided to devote its organization and time to the development and exploitation of its system in the various countries in which it has patents rather than invest in an expensive plant for the development of the manufacture. The Dodge Coal Storage Company, appreciating the great value of the telpherage system and the admirable solution it presents of certain conveying problems, has acquired from the United Telpherage Company exclusive rights to the manufacture and sale in the United States. All current correspondence, plans, drawings and patents are transferred to the Dodge Coal Storage Company, and both parties to the agreement are and will continue to act in hearty co-operative accord.

WESTERN ELECTRIC'S PACIFIC COAST BRANCH.—It is understood that the Western Electric Company, of New York and Chicago, is preparing plans for increasing the manufacturing facilities of its Pacific Coast branch, known as the California Electrical Works. The present offices and factory in San Francisco are several blocks apart. Negotiations are in progress for the purchase of property in a central location, not far from the present supply house on Mission Street. It is the intention to erect a large brick building having about 100,000 square feet of floor space, to be occupied by the factory, warehouse and salesrooms, with the offices on the upper floors. The company does a great deal of repair work for the Pacific States Telephone & Telegraph Company, besides engaging in contracting on wiring and electric power plants.

THE BAKER ELECTRIC COMPANY, of Hartford, Conn., was organized March 21 and began business March 22. The company will manufacture the Baker static machine and X-ray apparatus, stereopticons and other projection goods. The officers are as follows: George W. Christolph, president; Robert H. Lewis, vice-president; Foster E. Harvey, secretary; Burton E. Baker, treasurer. The above-named officers and Major L. R. Cheney make up the directors. The corporation's capital stock is $50,000, and the office is in the Phœnix Mutual Building, Hartford.

SOUTHERN WATER POWER DEVELOPMENT.—F. R. Dravo, president of the Dravo Contracting Company, of Pittsburg, Pa., has forwarded the necessary papers for the organization of a company to develop Cherokee shoals, on the Savannah River. Georgia and South Carolina have both given consent to the building of the dam, and as soon as the electric plant is in operation near Elberton, Ga., Judge W. F. Cox will erect a cotton mill near the site of the proposed dam.

LARGE CAR ORDER.—The Chicago City Railway Company has let the contract for 200 new car bodies to the J. G. Brill Company, of Philadelphia. This being one of the few large car orders of the year, it was competed for very strongly. The McGuire-Cummings Mfg. Co. will supply 424 standard M. C. B. trucks for the new cars. The company also has engaged the services of Ford, Bacon & Davis of New York and New Orleans, to look over the property and make recommendations and estimates on cost of reconstruction and improvement to put the property in good shape.

INTERIOR ELECTRIC LIGHT FITTINGS.—Mr. J. S. Webster, manager of the electrical department of Farwell, Oznum, Kirk & Company, of St. Paul, is about to draw up specifications for the electrical installation of a nine-story warehouse and office building, and desires to receive from manufacturers descriptive matter relating to the latest types of fittings for both concealed and open work, panel boards, etc. About 1,000 incandescent and some arc lamps will be installed.

SUSQUEHANNA ELECTRIC POWER COMPANY.—Following are the names of the officers of the Susquehanna Electric Power Company, the organization and plans of which were noted in these columns March 25: President, James H. Harlowe, of Baltimore, Md.; vice-president and treasurer, George T. McGaw, of Baltimore, Md. M. H. Houseman, of No. 3 East Lexington Street, Baltimore, Md., is the attorney.

TELEPHONE SUPPLIES WANTED.—Mr. L. W. Moore, of Lyons, Ga., writes as follows: "Our people are in the field for telephone supplies for an independent exchange stock company, now applying for a charter, and they want catalogues and prices."

ALASKA CABLE CONTRACT.—General Greely, chief signal officer of the army, has awarded the contract for the cable for the Alaska line and the cable for the fire control system to the Safety Insulated Wire & Cable Company at its bid of $150,000.

ELECTRIC POWER PLANT.—The Walter Baker Company, manufacturer of chocolate, is building a new power plant at Dorchester, Mass., to supersede its present four separate power plants. From this new plant power will be distributed electrically to all parts of its works. The new equipment consists of high pressure boilers from the special designs of Dean & Main; two 750-kw alternating-current generators driven by vertical cross compound condensing engines, and two 125-kw direct-connected alternators driven by Watertown four-valve engine. Messrs. Dean & Main have incorporated in this plant many special features, and it is their expectation that this will be one of the most complete, economical and up-to-date power stations ever installed.

THE WORLD'S COMMERCE.—The Board of Trade of London issued March 30 a bulletin giving a summary of the world's trade for the year 1904. It shows that the import trade of the United Kingdom for that period aggregated $2.205,200,000, that of the United States $1,079,070,000 and that of Germany $1,572,745,000. The value of exports from the United Kingdom was $1,504,080,000, from the United States, $1,485,155,000 and from Germany, $1,293,275,000.

PUMPING EQUIPMENT FOR CHICAGO.—The International Steam Pump Company, New York City, through its Snow Steam Pump Works, Buffalo, branch, has been awarded the contract for a 20,000,000-gallon pumping engine to be installed in the Sixty-eighth Street pumping station, Chicago, Ill.

G. E. DYNAMOS FOR ST. JOSEPH, MO.—General Electric dynamos have been ordered for installation in the municipal lighting plant to be built at St. Joseph, Mo.

Financial Intelligence.

THE WEEK IN WALL STREET.—Money is in more active demand at the interior, in regular trade channels, and rates tend to stiffen. The stock market was narrow and irregular, but showed tendencies to recover from bearish pressure developed in consequence of the dullness and the disposition of large interests to wait for easier monetary conditions. Electric and traction stocks attracted no particular attention and there were no features among them. Both of the Allis-Chalmers issues recorded advances, common 1⅞ points, closing at 17⅜, and preferred 6 points, closing at 62. General Electric was quiet and weak, closing at 185½, which is a net decline of 1½ points. Westinghouse common closed at 182, a decline of ¾. Electric Storage Battery was strong, advancing from 84⅜ to 89½, but receded and closed at 88⅞, which is a net gain of 5⅛ points. Brooklyn Rapid Transit ranged between 66 and 68¼, the closing price being 67⅝, a net gain of ¾. Metropolitan Street Railway closed at 122⅞, this being a gain of ⅜ point. Interborough Rapid Transit fluctuated between 201 and 211¾, but lost some of the gain and closed at 207, a loss of 2¾. Western Union made a fractional gain, closing at 93¼. The curb market was quiet for the most part, with irregularity in the usually active issues. Interborough Rapid Transit was weak at times, but United Copper advanced sharply. Following are the closing quotations of April 4:

NEW YORK

	Mar. 28	Apr. 4		Mar. 28	Apr. 4
Allis-Chalmers Co.	16	16¾	Electric Vehicle pfd.	21	21
Allis-Chalmers Co. pfd.	60	60⅛	General Electric	184½	187
American Tel. & Cable.	90	90	Hudson River Tel.	..	..
American Tel. & Tel.	144	144	Interborough Rap Tran.	201¾	212¾
American Dist. Tel.	32	32	Metropolitan St. Ry.	122¾	122⅞
Brooklyn Rapid Transit	66⅝	67⅛	N. Y. & N. J. Tel.	..	..
Commercial Cable	..	..	Marconi Tel.	..	..
Electric Boat	37	37	Western Union Tel.	92⅝	92¾
Electric Boat pfd.	83	75	Westinghouse com.	175	180
Electric Lead Reduction	¼	¼	Westinghouse pfd.	189	189½
Electric Vehicle	12	1			

BOSTON

	Mar. 28	Apr. 4		Mar. 28	Apr. 4
American Tel. & Tel	144	144⅞	Western Tel. & Tel. pfd.	*101	*101
Cumberland Telephone	119¼	119½	Mexican Telephone	1⅛	1⅛
Edison Elec. Illum.	*256	255	New England Telephone	136½	136
General Electric	184	186½	Mass. Elec. Ry.	20⅜	21⅛
Western Tel. & Tel.	20	*20	Mass. Elec. Ry. pfd.	67	69

PHILADELPHIA

	Mar. 28	Apr. 4		Mar. 28	Apr. 4
American Railways	52	54	Phila. Traction	..	..
Elec. Storage Battery	84	88⅞	Phila. Electric	11	11⅜
Elec. Storage Battery pfd.	..	..	Phila. Rapid Trans.	29⅞	31¼
Elec. Co. of America	11⅛	12⅛			

CHICAGO

	Mar. 28	Apr. 4		Mar. 28	Apr. 4
Central Union Tel.	.	†	National Carbon pfd.	113	†
Chicago Edison	..	†	Metropolitan Elev. com.	23	†
Chicago City Ry.	*196	†	Union Traction	10	†
Chicago Tel. Co.	..	†	Union Traction pfd.	39	†
National Carbon	45	†			

* Asked. † Holiday on account of Election.

NEW HAVEN RAILROAD'S TROLLEY BUSINESS.—In the seven months that the New Haven Railroad has been engaged in the electric railway business through the medium of the Consolidated Railways Companies, it has, it is stated, earned its fixed charges upon the bonds put out to cover the purchase of the roads and a surplus at the rate of 5 per cent. upon the common stock, all of which is in its treasury and represents the New Haven's investment of $10,000,000 in Connecticut street railways.

CANADIAN GENERAL ELECTRIC REPORT.—The condensed report of the Canadian General Electric Company for the year ended December 31, 1904, shows:

Profits for year	$582,520
Dividends	284,890
Balance	$297,630
Interest reserve and written off	296,486
Surplus	$1,144
Previous surplus	80,770
Total surplus	$81,914

The general balance sheet as of December 31, 1904, follows:

Assets:	
Patents and contracts	$250,000
Factory, plants, etc.	3,157,413
Patterns and drawings	100,000
Machinery and tools	375,838
Cash	7,163
Accounts receivable	1,010,352
Notes receivable	76,725
Brantford Street Ry. Co. bonds	125,000
Merchandise inventory	1,685,097
Expenditure on contracts (net)	92,968
Insurance unexpired	16,777
Total	$6,897,333
Liabilities:	
Capital stock	$2,968,900
Accounts and bills payable	918,472
Canadian Bank of Commerce (current)	1,305,162
Canadian Bank of Commerce (special)	90,466
Northey Company mortgage bonds	160,000
Mortgages payable	32,650
Reserve fund	1,239,770
Contingent account	100,000
Profit and loss account	81,913
Total	$6,897,333

The company has carried over uncompleted contracts from 1903 amounting to $2,730,000, and since the first of January to March 5 new contracts to the amount of $1,852,000 have been closed, making in all a gross total of $4,118,000, or over 35 per cent. more than the capital of the company. Permission will be asked the shareholders to issue $900,000 new stock, being at the rate of one new share for three old shares of the common stock.

TELEPHONE EARNINGS.—The *Wall Street Journal* says: "Thirteen of the Bell telephone subsidiary companies have reported gross earnings and the number of subscribers for the year ending December 31, 1904. The average gross earnings of these companies were practically $50 per subscriber. Aggregate statistics of the number of subscribers and the amount of gross earnings of these thirteen companies follow: Total subscribers January 1, 1904, 632,083; total subscribers January 1, 1905, 745,098; gross earnings for year, $33,730,318; gross earnings per subscriber January 1, 1904, $53.36; gross earnings per subscriber January 1, 1905, $45.27; average earnings per subscriber year 1904, $49.32. The thirteen companies comprise a little more than one-third of the entire Bell telephone system. They do not include the New England Telephone Company, which has not yet made its report for the year 1904, but which earned an average of $62.50 per subscriber in 1903; nor do they include the New York Telephone Company, which makes no reports, but whose average earnings per subscriber are probably above $60. These figures support the contention that the gross earnings of the entire Bell system average about $50 per subscriber. An approximate estimate of the gross earnings of the Bell system for the year 1904 is given in the following: Average number of subscribers, 1904, 1,662,400; gross earnings at $50 per subscriber, $83,120,000; long distance gross earnings, $5,575,000; total gross earnings Bell system, 1904, $88,695,000."

DIVIDENDS.—The Westinghouse Machine Company directors have declared the usual quarterly dividend of 2½ per cent. on the capital stock, payable April 10. The directors of the Manufacturers' Light & Heat Company have declared the usual quarterly dividend of 1½ per cent., payable April 20. The Manchester Traction, Light & Power Company has declared a regular quarterly dividend of 1½ per cent., payable April 15. The New York & New Jersey Telephone directors have declared the regular quarterly dividend of 1½ per cent., payable April 15.

AMERICAN TELEPHONE & TELEGRAPH COMPANY.—At the annual meeting of the American Telephone & Telegraph Company, March 27, there were no changes in the directorate. Resolutions were passed authorizing the transfer of certain lines in the State of Georgia to the company actually operating them for $350,000, and in the State of Alabama for $148,000. This is merely a formal transfer designed to meet the legal requirements of these two States. The by-laws of the company, with certain amendments designed to facilitate the business of the company, were read by President Fish and approved.

ST. LOUIS COUNTY TELEPHONE.—The St. Louis County Telephone Company (independent) has sold $200,000 5 per cent. bonds to John H. Murphy, of St. Louis. The proceeds will be used for improvements and extensions to the system.

General News of the Week

The Telephone.

HUNTSVILLE, ALA.—The new $30,000 exchange of the Southern Bell Telephone Company at Huntsville, Ala., has been put into service. A common battery system has been installed in a new building and other improvements made.

HOT SPRINGS, ARK.—The independent telephone exchange has recently had installed by the American Electric Telephone Company, of Chicago, an increase in its switchboard capacity from 1000 to a total of 1320 line terminals. Since the above installation, an order has been given to the American Company for 180 additional lines.

ALHAMBRA, CAL.—The City Trustees have sold a telephone franchise to P. T. Spencer for $300 and cost of advertising. It is supposed he represents the Home Telephone Company.

REDDING, CAL.—Within the next month Redding and Kennett will be connected by a public telephone line. The only telephone line between the two places has been a private one that belonged to the Copper Company. The Sunset Telephone Company has purchased it and will remodel and improve it for public use.

COLUMBUS, GA.—The Southern Bell Telephone Company has bought the Adams Telephone lines in the section about Columbus, Ga., and will at once start a line to Omaha, Ga., the headquarters of the Adams system.

EL PASO, ILL.—The Grand Telephone Company of this city has been formed, capital $2500. Incorporated by Walter Stottler, C. A. Gull and others.

BONDVILLE, ILL.—The Bondville Telephone Company has been formed, capital $2,500. The incorporators are William H. Scott and George A. Keller.

MAQUON, ILL.—The Maquon Northeastern Farmers' Telephone Company has been formed with a capital of $1,600, by F. J. Walker, F. E. Nelson and others.

SPRINGFIELD, ILL.—The Richland & Shelbyville Township Mutual Telephone Company, of Richland Township, has been incorporated with a capital stock of $2,500. The incorporators are L. N. Douthit, James Stewardson and William H. Brown.

ROCK ISLAND, ILL.—An important meeting of the managers of the independent telephone companies in this part of the state has been held in Galva. The object of the gathering was the organization of an association of the telephone companies for mutual protection and benefit. The proposed organization will include the independent companies in the following 10 counties: Rock Island, Henry, Bureau, Stark, Knox, Mercer, Warren, Peoria, Marshall and Henderson. F. M. Ashe, of Kewanee, was elected temporary president of the proposed organization and W. J. McQuiston, of Monmouth, was elected temporary secretary.

WABASH, IND.—The Home Telephone Company, of this city, will establish an exchange at Lagro, on a franchise granted three years ago.

GREENTOWN, IND.—The Greentown Telephone Company has been incorporated with a capital of $30,000. Directors are J. M. Gleen and A. L. Bott.

FORT RITNER, IND.—The Fort Ritner Telephone Company has been incorporated with a capital of $486. The directors are E. E. Wicker, W. A. J. Holland and others.

SUMMITVILLE, IND.—The Summitville Telephone Company has filed articles of incorporation with the Secretary of State. The capital stock is $5,000. The directors are R. W. Ingils, A. A. Ingils and T. E. Cartwright.

WABASH, IND.—The consolidation of the Farmers' Mutual Telephone Company and the Home Telephone Company, of Whitley County, has been effected, and the farmers will increase the capital stock, make extensions and improvements.

BORDEN, IND.—The Farmers' Union Telephone Company has been incorporated, capital stock $1000. Directors: James H. Miller, Charles M. Collins, Henry McKinley, Lewis C. Johnson, A. C. Fordyce, B. F. Brown and Dennis McKinley.

CAMBRIDGE CITY, IND.—The Citizens' Telephone Company, of this city, has reduced the rate to country subscribers to $1 per month when paid quarterly in advance. This is the same rate given resident patrons in the towns of Cambridge City, Milton, Dublin and Germantown.

CONVERSE, IND.—A deal has been completed among the members of the Converse Telephone and the Converse Electric Light companies by which the Barger family is in possession of all the shares except 16. Officers are now L. T. Barger, president; J. C. Riley, vice-president, and O. L. Barger, secretary and treasurer.

FORT WAYNE, IND.—The Northern Indiana Telephone Association, which has for its purpose the improvement of the toll service in this part of the State, has been formed at Fort Wayne. Officers were elected as follows: President, William L. Moellering, of Fort Wayne; vice-president, P. L. Taylor, of Angola; secretary and treasurer, E. M. Popp, of Fort Wayne; executive committee: James W. Sale, Bluffton; J. S. Peabody, Columbia City; F. B. Schirmeyer, Decatur; Simon Strauss, Ligonier; W. A. Bohn, Fort Wayne.

SCIOLA, IA.—The Sciola Mutual Telephone Company has been organized The line will run from this city to Villisca.

EXLINE, IA.—The Exline Mutual Company has been formed, capital $2000. H. W. Farnsworth and others are incorporators.

SIOUX CITY, IA.—The New State Telephone Company will built trunk lines to South Omaha, St. Joseph, Kansas City and Chicago.

BRONSON, IA.—The Bronson Telephone Company has been formed, capital $5000. President, M. G. Smith; secretary, F. H. Oertel.

ALLISON, IA.—The Butler and Bremer County Mutual Telephone Company, with a capital of $10,000, has filed articles of incorporation with the State Auditor.

MUSCATINE, IA.—The Mississippi Valley Telephone Company will probably install a complete new system of cables in conduits and may effect an exchange.

FARNHAMVILLE, IA.—The Farnhamville Mutual Telephone Company has been formed, capital $10,000. President, C. C. Freeburn; secretary, J. C. Crissinger.

VILAS, IA.—Articles of incorporation have been filed for the Vilas Telephone exchange at Vilas, with a capital of $2000. Incorporators: M. B. Willard, F. B. Raymond, Eli Gray and others.

WHITE LAKE, IA.—The Aurora County Telephone Company has been formed at White Lake with a capital of $2000. Incorporators: Sadie V. Loevinger, Henry Hofmeister and Nelson Hoff.

BELLE PLAINE, IA.—The property of the telephone company that operates in Traer, through north Tama and in many other counties north and east of there is to be sold at auction next month to satisfy a judgment of $158,895 and $2500 costs.

TOPEKA, KAN.—The Independent Telephone Company has recently ordered a 1200-line magneto call switchboard system from the American Electric Telephone Company of Chicago. The equipment consists of two sections, oak cabinets. Each position is fully equipped and arranged for giving service to 200 subscribers' lines. It is made possible to operate so many lines for one operator's position through an efficient training of the operators, and also owing to the equipment provided for handling the entire service throughout the board, the American Company's flash-light transfer system having been adopted.

LOUISVILLE, KY.—The Snyder Telephone Company of Spencer County has been incorporated with a capital of $200.

HALLOWELL, ME.—The New England Telephone Exchange at this city has been destroyed by fire. Loss $1000.

ELLSWORTH, ME.—The New England Telephone & Telegraph Company is extending its lines to most of the Hancock county towns and villages this spring.

OWOSSO, MICH.—The annual meeting of the Union Telephone Company was held in Alma, when the following officers were elected: President, Mayor Stanley E. Parkhill, Owosso; vice-president, James Gibbs, Ithaca; secretary, J. H. Fildrew, St. Johns; treasurer, George F. Ward, Alma.

MARQUETTE, MICH.—It is reported that the Michigan State Telephone Company will during the coming year put in improvements in its service in the upper peninsula to the extent of many thousands of dollars. In the city of Marquette it is proposed to spend about $60,000 in perfecting the system. Another important movement will be the extension of a copper circuit from Nestoria to Ironwood, connecting with lines leading to Ashland, Duluth and other northwestern points.

LE SUEUR CENTER, MINN.—The Citizens' Mutual Telephone Company has been formed. F. M. Wrabek is secretary.

BRAINERD, MINN.—The Brainerd Telephone Exchange has been incorporated under the laws of the State, and hereafter will be known as "The Brainerd Telephone Exchange Company." Capital $50,000. Incorporated by C. A. Walker, Dr. Werner Hemsted and others.

MEXICO, MO.—At the annual meeting of the Laddonia, Rush Hill and Mexico Telephone Company, D. L. Rodgers was elected president. The other officers elected are: E. A. Feutz, secretary, and John Fry, J. W. Rosser and Earl Cunningham, directors.

SPRINGFIELD, MO.—A new section of multiple switchboard has been added to the Independent Exchange at Springfield, Mo. This is the second increase made by the Springfield Company since the original installation. The American Telephone Company, Chicago, supplied both sections.

HUMBOLDT, NEB.—The Richardson County Telephone Company has purchased the Verdon Mutual Company's stock and equipment with a view to consolidating the lines already in operation over the county.

ALBANY, N. Y.—A certificate of merger of the Wilson Telephone Company, and the Bell Telephone Company, of Buffalo, has been filed with the Secretary of State.

CLINTON, N. Y.—The Clinton Home Telephone Company has been incorporated by the Secretary of State, capital $25,000. Cory D. Hayes and G. T. Caldwell are the incorporators.

RENSSELAER, N. Y.—The Hudson River Telephone Company has purchased the Quigley property, on the northeast corner of Partition and Second Streets, on which site it will construct a modern telephone exchange.

THOMASVILLE, N. C.—J. F. Hayden has bought a controlling interest in the Lexington, N. C., telephone system and will make improvements.

YOUNGSVILLE, N. C.—The Southside Telephone Company, of Youngsville, has been chartered by the Secretary of State with an authorized capital of $10,000 and $500 paid in. G. T. Sykes, C. E. Timberlake, J. F. Mitchell and A. V. Bobitt are the incorporators.

GRAND FORKS, N. D.—Articles of incorporation for the Inter-State Telephone Company have been approved. The company is organized to put in rural telephone lines within a radius of from 25 to 50 miles of Grand Forks. The officers of the company elected are: President, Ole B. Dahl; vice-president, Arny Grundysen; treasurer, Anton Lyndon; secretary, James Elkington.

MARION, N. D.—A local telephone system is projected. W. C. McDowell is secretary.

WILLISTON, N. D.—H. L. Dow, of Williston, N. D., was granted a franchise for telephone line to Culbertson.

FARGO, N. D.—The fight of the Tri-State Telephone Company for a right of way through Fargo has at last been settled and the telephone company gained every concession asked in the original petition, which was turned down by the City Council.

CADIZ, OHIO.—The office of the Globe Telephone Company has been destroyed by fire with a loss of about $1000.

PLEASANT HILL, OHIO.—The Pleasant Hill Telephone Company has increased its capital from $10,000 to $20,000.

SANFORD, OHIO.—The Sanford Mutual Telephone Company has been formed, capital $5000, by C. A. Ray and W. Smith.

McCONNELSVILLE, OHIO.—The Home Telephone Company, of this place, has incorporated with a capital stock of $25,000.

ANDOVER, OHIO.—The Wayne Telephone Company has been incorporated with a capital of $6,000. The incorporators are S. A. Babcock, R. P. Miner and others.

ATTICA, OHIO.—The Attica Bell Telephone Company, of Seneca County, $10,000 capital, has been incorporated by Roy C. Carpenter, F. C. Myers, S. F. Kaufman, J. C. Niederly and J. N. Starr.

RUSHVILLE, OHIO.—The Central Union Telephone Company has closed a contract with the company at Rushville whereby it is granted a franchise to operate its lines in and around Rushville. The company is incorporated for $15,000.

COLUMBUS, OHIO.—Extensive improvements, involving a total expenditure of hundreds of thousands of dollars, are contemplated by the Central Union Telephone Company. New systems will be installed at Athens, Coshocton and Lancaster, and cable improvements will be made at Logan, Zanesville and Columbus.

KENTON, OHIO.—A meeting of the majority of the bondholders of the Orange (Texas) Telephone Company has been held and proceedings taken to stay the action for a receiver and to reorganize the company. E. L. Bruce, of Orange, was chosen as the new president; A. L. Ford, of Orange, vice-president, and E. E. Weber, secretary and treasurer.

SANDUSKY, OHIO.—The telephone war in this city has been practically ended, and the Retail Druggists' Association, which ordered all Sandusky telephones thrown out March 1, accepted a new proposition of the company and will have the telephones installed April 1. All other organizations have agreed to the change to the meter or nickel-in-the-slot system.

CLEVELAND, OHIO.—At a meeting of the board of directors of the Cleveland Telephone Company, held a few days since, Mr. L. G. Richardson was elected president of the company. Mr. Richardson is also president of the Central Union Telephone Company. No change in policy is contemplated by this action, but the two companies are so closely allied that it was thought best to put them under one executive head.

HOMESTEAD, OKLA.—The Consolidated Rural Telephone Company, with a capital of $2400, has received legal standing. It was incorporated by W. R. Taylor, J. T. Parker and others.

GUTHRIE, OKLA.—The Rock Falls Mutual Telephone Company which will be operated in Kay County has obtained its charter. Its capital is $3000, and the incorporators H. W. Jones, M. I. Wittam and others.

GUTHRIE, OKLA.—The following officers have been elected for the coming year by the Pioneer Telephone & Telegraph Company: E. D. Nims, president; J. M. Noble, vice-president and general manager; E. E. Westervelt, secretary and treasurer.

HURON, S. D.—The Long-Distance Telephone Company of Huron has been formed; capital $25,000.

ARLINGTON, S. D.—The Arlington-Hetland Telephone Company will make extensions and improvements.

GARRETSON, S. D.—As the result of a meeting of a large number of business men of this place and farmers residing in this vicinity, what will be known as the Palisade Telephone Company has been organized. The following officers were elected: President, Adolph Koch; vice-president, A. O. Lerdahl; secretary, John Engebretson; treasurer, F. E. Locke.

LEBANON, TENN.—The Corum Telephone Company has been incorporated with a capital of $5,000, and headquarters in this city, by J. J. McFarland, J. D. Corney and others.

HUNTINGDON, TENN.—The Southwestern Dixie Telephone Company, capitalized at $1000, has been incorporated. E. B. Simmons is president; F. P. Compton, vice-president, and D. R. McAskill, secretary-treasurer. The lines of the company extend to points in Carroll, Henry and Benton counties.

BEAUMONT, TEX.—The Beamont Telephone Company is planning extensive improvements and additions to its property and plant in this city.

WINCHESTER, VA.—The Shawnee Telephone Company has been formed. A. R. Richards, president, Winchester; T. W. Steck, secretary and treasurer, Opequan; H. F. Byrd, vice-president, Winchester. Capital stock $1000.

CATLETT, VA.—The Cedar Run Mutual Telephone Company, of Catlett, has been chartered by the State Corporation Commission with a capital of $5000. F. S. Enslor, J. L. Carroll, J. B. Powers, L. W. Trenis, B. F. Colvin, all of Catlett, are directors and stockholders.

WAUPACA, WIS.—The sale of the Citizens' Telephone Exchange, which was to have been held, was stopped by A. L. Hutchinson, who had an injunction served on H. G. Slater.

Electric Light and Power.

LINEVILLE, ALA.—The Council has granted John S. Jamison and associates a franchise for water works and electric light plant and telegraph and telephone system.

SAN FRANCISCO, CAL.—The stockholders of the Battle Creek Power Company will hold a special meeting, June 5, to take action on a proposition to issue bonds to the amount of $1,000,000. E. W. Suttcliffe, the promoter of the company, is superintending the construction of the hydro-electric plant on Battle Creek, Shasta County, Cal. It is reported that one transmission line will extend into the gold-dredging district near Marysville and possibly Oroville. It is also rumored that the company is allied to the Northern California Power Company, the recent annual report of which said that it was proposed to extend its system to the Orovilie mining district.

OURAY, COLO.—The mayor and council are investigating the cost of an electric light plant.

HARTFORD, CONN.—The Baker Electric Company of Hartford has organized by the election of the following officers: President, George W. Christoph; vice-president, Robert H. Lewis; treasurer, Burton E. Baker; secretary, Foster E. Harvey.

WALLINGFORD, CONN.—The Board of Commissioners of the borough electrical works, has recommended the purchase of certain water privileges on the Quinnipiac River, to be used in connection with the electric plant. The property lies along the banks of the Quinnipiac and includes three water privileges and buildings thereon which can be purchased for $4000.

CHESHIRE, CONN.—At a special town meeting it has been decided to accept the proposition of the Connecticut Railway, Light & Power Company, which operates the interurban line between New Haven and that place. This concern is to furnish 52 lights at the rate of $20 per year for each light on a contract for five years, with refusal for a renewal at the expiration of that time if the town authorities are satisfied.

WASHINGTON, D. C.—Bids will be received April 12 at the Treasury Department for furnishing and placing in position combination gas and electric fixtures in the following buildings: U. S. Post Office at Batesville, Ark.; Traverse City, Mich.; Torrington, Conn., and U. S. Custom House, Hartford, Conn. H. A. Taylor is assistant secretary.

MONROE, GA.—J. B. McCrary, of Senora, has been selected to prepare plans for an electric light plant. An election to vote on issuing bonds to the amount of $15,000 for the same will be held on April 20.

WEISER, IDA.—Articles of incorporation of the Weiser Electric Light & Power Company, with a capitalization of $50,000, have been filed.

BOISE, IDA.—The Barber Lumber Company, of this city, has awarded a contract to the Westinghouse Electric & Manufacturing Company for three 300-kw. alternating-current generators, for installation in its plant in this city.

SHOSHONE, IDAHO.—The Shoshone Power Company has been incorporated with a capital of $5,000,000 to build a plant at Shoshone Falls. The incorporators are Francis M. Lyman, J. A. Bagley, L. R. Martineau and others.

EUREKA, ILL.—W. J. Whetzel has secured a franchise for an electric light and power plant to cost $6000.

MUNCIE, IND.—The Citizens Electric Light Company has been incorporated with a capital of $200,000 by W. F. Warner, H. J. Keller, C. R. Hathaway and others, to construct an electric light plant.

CONNERSVILLE, IND.—The Connersville Gas, Electric Light & Power Company, recently acquired by purchase from the receiver by George B. Markle, of Hazleton, Pa., has been reorganized with George B. Markle as president and treasurer, and R. N. Burgess, of New York, vice-president and secretary. The plant will be greatly improved and the business expanded.

INDIANAPOLIS, IND.—Beginning April 1 the electric lighting of Indianapolis for the next ten years will be furnished under the contract made by the Board of Public Works with the Indianapolis Light & Heat Company. Enclosed arc lamps will be furnished for $74 each, the service being all night, from dusk to dawn. The increased number of lights required by the new contract makes it necessary for the company to make extensive improvements and place a considerable amount of new machinery. A part of the service will be delivered from the Marion County Light & Heat Company's plant which has been consolidated with the contracting company. The contract in effect provides that property owners may petition the Board of Public Works for an extension of electric wiring for domestic service and the company must give the service at 10 cents per kilowatt.

CENTERVILLE, IOWA.—The citizens have voted to grant two electric light franchises, one to the Home Electric Company, and the other to the Mutual Electric Company.

LYONS, KAN.—The Lyons Electric & Mfg. Company will receive bids about May 10 for machinery, for an electric light plant, which will cost from $8000 to $10,000.

ABBEVILLE, LA.—The citizens of Abbeville have voted to issue $45,000 bonds for water works, a sewerage system and electric light plant.

BALTIMORE, MD.—The contract awarded by the Board of Awards, March 15, to the Consolidated Gas, Electric Light & Power Company for furnishing and operating electric arc lamps, was for a term of five years, at a cost of $67.49 a lamp a year. This is a saving to the city of $32.43 a lamp a year when compared with the present cost of $99.92 each lamp a year, or in the aggregate, based upon 1800 lamps now in service on the streets and in the parks and squares, an annual saving of $58,374, and, during the existence of the contract, a saving to the city of $291,870.

HAYDENVILLE, MASS.—The lighting of this town by the Mill River Electric Light Company is likely to cease, the committee and the company being unable to agree as to prices.

WASHINGTON, D. C.—Bids will be received April 18 at the Bureau of Supplies and Accounts, Navy Department, Washington, for furnishing at the navy yards at Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Washington, D. C., and Norfolk, Va., the following supplies: motors, electrical supplies, conduit, P. & B. electrical compound, incandescent lamps, etc. Address H. T. B. Harris, Paymaster-General, U. S. N.

DALTON, MASS.—The powerhouse to contain the Z. & W. M. Crane new water-power project will be erected in the eastern part of the town. The new plant will be fully installed by July.

WARF, MASS.—The Ware Electric Company has elected the following officers: President, A. Bryson; vice-president, George M. C. Barnard; clerk and treasurer, C. C. Hitchcock. Directors: F. M. Sibley, E. H. Gilbert and Henry K. Hyde.

HYANNIS, MASS.—There is talk of putting in an electric light plant here by private parties. Municipal street lighting in Hyannis is considered a miserable failure. Several attempts made during the past 20 years have been abandoned after the novelty wore off for want of funds or competent care.

NANTUCKET, MASS.—All the property of the Nantucket Gas & Electric Company, together with franchises, bills, etc., but not including books of account, or cash on hand or deposit, has been sold at receivers' sale to Leslie K. Storrs, for $26,000. The plant is now in active operation and furnishes all the gas and electric lighting for the town of Nantucket.

DETROIT, MICH.—The House has passed a bill granting permission to this city to issue $150,000 bonds for lighting improvements.

DULUTH, MINN.—Bids will be received April 10 by the Common Council for $240,000 bonds; $140,000 for water and light, and $100,000 bridge bonds. H. W. Cheadle is city clerk.

WALKER, MINN.—Bids will be received April 17 by the Village Council for $4000 in bonds issued for the purpose of removal and extension of electric light and water plant. Chas. Kinkele is president.

LIBERTY, MISS.—The Board of Aldermen has granted W. M. White a franchise for water works and an electric light plant.

MARSHALL, MO.—A. H. Bickmore & Co., of New York City, has purchased the Marshall gaslight plant owned by Thomas Boatright of this city and the electric light plant owned by W. E. McCully, of Macon, Mo. The two plants sold for $62,000. Extensive improvements will be made at once, and the two properties will be consolidated.

NEW FRANKLIN, MO.—The action of the City Council in granting an electric light franchise to T. H. Todd and Wallace Estell of this city was ratified by a vote of the citizens at a special election held for that purpose March 27.

POTSDAM, N. Y.—The citizens have voted to issue $40,000 bonds, to install a municipal electric light plant.

MONROE, N. Y.—Z. Paddleford and Luther Terwilliger are incorporators of a company organized to supply electricity in Monroe, Chester, Turner, Central Valley, Highland Mills and Hillburn.

FORT ONTARIO, N. Y.—Bids will be received May 2 by Capt. W. M. Caulling, Q. M., U. S. A., Oswego, N. Y., for furnishing material and labor necessary for installing interior and exterior lighting at Fort Ontario.

LOCKPORT, N. Y.—The Iroquois Construction Company has sublet to the Archbold-Brady Company, of Syracuse, the contract to build the transmission lines for the Niagara, Lockport & Ontario Power Company from Niagara Falls to Lockport and Rochester, and from Lockport to Buffalo.

ROCHESTER, N. Y.—The Rochester Railway & Light Company has extensive improvements under way. The company will expend something over a million and a quarter dollars this year. New apparatus will be installed in stations No. 3, No. 4 and No. 5. At station No. 6 a storage battery plant will be laid down. For street lighting the old open series arc lamps will be replaced by alternating-current enclosed series lamps.

WASHINGTON MILLS, N. Y.—Within a few months the benefits of the electricity generated at Trenton Falls will be extended to several of the busy little hamlets of the Sauquoit Valley. At a meeting of the board a lighting district, covering the territory mentioned, was established and, through M. Jesse Brayton, who was present as a representative of the Utica Gas & Electric Co., the board entered into a contract with that concern to run a line down the valley. The lights are to be turned on by June 1.

BURLINGTON, N. C.—The town of Burlington will vote on $10,000 additional bonds for electric lights. The bonds will be of the $500 denomination, bearing five per cent. interest, payable semi-annually, and running for thirty years.

LACONIA, N. H.—The Laconia Electric Light Company has secured the contract for lighting the city for a period of ten years for about $7,500.

LACONIA, N. H.—The property of the Laconia Electric Lighting Company, which has held the contract for the city lighting, has passed to the control of a company composed of Massachusetts and Rhode Island capitalists, who propose to enlarge the plant to furnish electric power and to extend the lighting service to The Weirs.

MADISON, OHIO.—The question of establishing an electric light plant is under consideration here.

BELPRE, OHIO.—There is a movement here looking to the construction of water works and an electric light plant.

TOLEDO, OHIO.—The first steps toward a municipal electric lighting plant have been taken in this city. A Council committee has been appointed to investigate the operation of municipal lighting plants in other cities, the cost of installing a 2000-arc light plant for Toledo, and the probable cost of operation.

OREGON CITY, ORE.—The Portland General Electric Company has petitioned the County Commissioners for a franchise over the county roads, between Oregon City and Aurora. It will also petition for a franchise in Marion County for a transmission line between Aurora and Salem.

PROVIDENCE, R. I.—It is reported that the Narragansett Electric Company will expend about $200,000 on underground construction and rewiring of houses on the east side.

GREENVILLE, S. C.—A. G. Furman, of Greenville, president of the Saluda River Power Company, writes that about $350,000 will be expended by this company. The work will include a dam and electric transmission of 2600 kilowatts at 6600 volts to Greenville, a distance of 5 miles. Lockwood, Greene & Company are the engineers.

LAWRENCEBURG, TENN.—F. M. Lincoln is interested in the construction of an electric light plant.

ATHENS, TENN.—The Athens Light & Power Company proposes to purchase additional equipment.

SHELBYVILLE, TENN.—There is a movement here looking to the purchase by the town of the present water works and electric light plant or the construction of new plants.

BRISTOL, TENN.—The City Council has granted to J. Edw. Durham, of Philadelphia, Pa., and Wm. B. Cutter, of Buffalo, N. Y., a franchise to furnish a new water supply and develop Holston River water power for the purpose of furnishing the city with electric power.

DICKSON, TENN.—The citizens have voted to issue $6000 bonds for an electric light plant.

BARTLETT, TEX.—R. S. Decker is reported to have secured a franchise for an electric light plant.

SAN AUGUSTINE, TEX.—A. A. Sheffield is reported interested in the construction of an electric light plant.

McKINNEY, TEX.—The Hunter Electric Light Supply Company, of Dallas, has secured the contract for a municipal electric light plant to cost $6500.

SUMAS, WASH.—R. S. Fisher, of Seattle, has petitioned Council for a franchise for water works and an electric light plant.

RITZVILLE, WASH.—The electric light plant has changed hands, C. O. Greene disposing of the same to N. H. and O. H. Greene, president and cashier, respectively, of the Pioneer State Bank, who plan to spend considerable money on the plant in the near future in the way of rewiring the town and putting in new machinery.

QUEBEC, QUE.—The Quebec Railway, Light & Power Company has decided to construct a dam on Montgomery River at the foot of the Natural Steps. The Quebec-Jacques Cartier Electric Company has decided to construct an additional dam. Total cost of improvements contemplated by both companies is reported to be $250,000.

The Electric Railway.

BIRMINGHAM, ALA.—It is understood that a new car line is in contemplation, extending from the present lines of the Birmingham Light & Power Company, in Birmingham, to Jonesboro, a distance of about two miles, to connect that town with Bessemer.

SANTA ROSA, CAL.—The Petaluma & Santa Rosa Railroad is to extend its line at once from Green Valley to Forrestville.

OROVILLE, CAL.—The franchise granting the right to build and operate a railway between Chico and Oroville has been sold to A. E. Boynton.

SALINAS, CAL.—A contract has been signed by M. V. Quigg, president of the Monterey County Gas & Electric Company, in which he agrees to build, equip and put in operation an electric railway for passengers and freight traffic between Monterey and Salinas, which will ultimately be extended to Hollister and later into the San Joaquin Valley and Fresno.

WILMINGTON, DEL.—It has been announced that the West Chester, (Pa.) Street Railway Company will extend its road to the Delaware State line by way of the Brandywine Summit camp-meeting grounds, and that a Delaware company will then connect with it. This will give a direct connection between West Chester and Wilmington, and will also develop Brandywine Summit.

DANVILLE, ILL.—The Danville Street Railway & Light Company has purchased for installation in its plant a 1500-horse-power engine from the Hooven-Owens-Rentschler Company, Hamilton, Ohio, and a 60-cycle alternator from the General Electric Company, Schenectady, N. Y.

KANKAKEE, ILL.—The Kankakee & Western Electric Company has been incorporated with a capital stock of $15,000 to construct an electric railway from Kankakee to Milk Grove. The incorporators are John Small, Charles B. Campbell and Charles E. Foley.

INDIANAPOLIS, IND.—Articles of incorporation have been filed with the State Secretary for the Indiana, Hartford City & Eastern Traction Company, capitalized at $25,000. The company, which has its headquarters at Alexandria, is a reorganization of the Indianapolis, Hartford City & Celina Traction Company, incorporated last year. The directors are C. G. Buell, A. M. Weeden, R. G. Kirkpatrick and others.

DES MOINES, IA.—H. H. Polk president of the Interurban Railway Company, of Des Moines, announces that the company has finally decided to construct the line to Perry, as well as the line to Woodward, this year.

WORCESTER, MASS.—It is reported that negotiations are being conducted for the purchase by the Consolidated Railway Company, acting for the New York, New Haven & Hartford Railroad, of the Worcester Con-

MECHANICSVILLE, N. Y.—The Hudson River Water Power Company, it is reported, has contracted to furnish the New York Central & Hudson River Railroad with power for 25 years. Power will be delivered in July from Spier Falls and Schoharie Falls, together with current from a temporary steam plant to be erected at Utica. It is further reported that the company will now complete its plans for utilizing the waters of Schoharie River.

solidated Street Railway, which operates all the city lines here, and the Boston & Worcester Railway, which operates between Boston and Worcester.

JACKSON, MICH.—It is understood that J. D. Hawks and Bird S. Coler, the latter of New York City, are making the plans for the improvement of the Jackson City Railway; also the Detroit, Ypsilanti, Ann Arbor & Jackson Electric Railway, and that a community-of-interest arrangement has been arranged between them and W. H. Hand, representing the Adrian & Jackson Railway. It is also understood that the projected Jackson & Lansing Railway, in which these parties and the Bolands are interested, will also be built this summer.

CARTHAGE, MO.—The Southwest Missouri Electric Railroad Company has begun active preparations for the construction of a road bed from Webb City to Oronogo.

FINDLEY, N. Y.—The Findley Lake & State Line Street Railway Company of Findley has been incorporated to construct 13 miles of electric railway in Chautauqua County; capital $130,000. Directors: F. R. Nichols, Titusville; I. A. Pond, Corry, Pa.; E. A. Austin, Cutting.

NEW YORK, N. Y.—August Belmont's proposition for a four-track system on the Second Avenue Elevated Road to connect with the Subway at Fourth Street, has been rejected by the committee on plans of the Rapid Transit Commission. Tentative projects for the expenditure of $250,000,000 on subways and other traffic lines, $120,000,000 to be spent immediately, were considered for submission to the full commission at its regular meeting.

SCHENECTADY, N. Y.—General Manager Peck of the Schenectady Railway announces that the work of constructing the Cohoes and Saratoga extensions will be begun early in the spring. The two extensions will aggregate 20 miles of road. The Cohoes road will extend from Lathams Corners northward over private right of way to Cohoes. The company is procuring a private right of way from Ballston to Saratoga, paralleling the Delaware & Hudson Railroad.

MANSFIELD, OHIO.—Col. W. W. Cockley, of Lexington, Ohio, is at the head of a company formed to build a line from Mansfield to Lexington, Bellville, Fredericktown and Mt. Vernon.

TOLEDO, OHIO.—The Toledo Railways & Light Company has announced a dividend of 2 per cent. on the stock for the year, the first payment of one per cent to be made April 15. This is the first dividend ever paid on the stock.

SPRINGFIELD, OHIO.—An auditing committee appointed to investigate the Springfield, Charleston, Washington C. H. & Chillicothe Traction Company, now in the hands of a receiver, reports that the indebtedness of the company is $182,000, of which $78,000 has been paid. The assets of the company are $123,000, including road completed and material on hand No plans have been arranged for reorganizing the road, but S. B. Rankin, the receiver, has made arrangements to put the road in operation again.

FREMONT, OHIO.—Judge J. F. Bunn and C. J. Yingling, of Tiffin, and W. A. Storey and J. P. Myers, of Chillicothe, are again taking up the project of building an electric railway from Tiffin to Fremont. This is one of the most important links in the traction system of Ohio, as it would complete a through line from Cincinnati and Dayton to Cleveland. Two years ago these parties obtained a franchise for the line and did considerable work. Recently they were sued by the County Commissioners to recover on a bond given at the time. Now they state that the road will be built in the near future.

SCRANTON, PA.—The Scranton Railway Company has awarded the General Electric Company a contract for a 500-kw. vertical steam turbine.

PHILADELPHIA, PA.—The foreclosure proceedings of the Philadelphia & Lehigh Valley Traction are moving slowly. No date has yet been fixed for a sale of the property. The bondholders' committee has been holding a few meetings recently. It is believed that the Lehigh Traction reorganization interests will be bidders for the property when it is finally brought to a sale.

POTTSVILLE, PA.—It is stated that the transfer of the Schuylkill Traction & Lakeside Electric Railways to the Pottsville, Frackville & Shenandoah Railway Company will be made this week. The purchase price was $1,200,000, it is stated. The company proposes to build a third-rail line between Shenandoah and Pottsville via Maizeville and Frackville, with an extension to the Mibers' Hospital at Fountain Springs. The Schuylkill Traction & Lakeside lines will be greatly improved.

CHARLESTON, S. C.—The Charleston & Summerville Railway Company, of which Ogden Edwards, of Troy, O., is president, and Col. George Tupper, of Summerville, secretary and treasurer, has entered into a contract with the Southern Electric Construction Company, of which Gen. Warner, of Gainesville, Ga., is president, and J. W. Davis, of Troy, O., secretary and treasurer, to build an electric railway in Charleston, therefrom to Summerville and in Summerville, a total length of about 25 miles. The powerhouse is to be located at some point between Charleston and Summerville. The capacity of the plant will be 1500 kw.

GALVESTON, TEX.—George E. Woodhouse, of the Bloomington & Champaign Electric Railway, of Bloomington, Ill., is said to be interested in the building of an electric railway between Galveston and Houston. This makes the third project for a road between these cities.

OGDEN, UTAH.—David Eccles, of this city, has completed plans for the extension of the Ogden Rapid Transit Company's system for several miles through Ogden Canyon, the enterprise to be contingent upon an agreement from farmers in that section to raise sugar beets for transportation to the factory.

OGDEN, UTAH.—The City Council has under consideration two applications for street railway franchises. J. E. Bamberger, of Salt Lake and B. Mahler, of Cleveland, Ohio, being the applicants. The prospective route of Bamberger's system is from Salt Lake to this city, while Mr. Mahler's proposed line will extend from Salt Lake through Ogden to Brigham City. Citizens living in towns north of Ogden have petitioned the Council to grant the Mahler franchise.

RICHMOND, VA.—The Bluestone Traction Company, of Virginia, has been commissioned by the State Corporation Commission. The officers are John Walters, president, Graham, Va.; J. N. Sluss, vice-president, Graham, Va.; Edwin Mann, treasurer, Bluefield, W. Va. The capital stock will be $100,000.

SPOKANE, WASH.—The rival street railway companies of this city have practically arrived at an agreement, whereby the Spokane & Inland Railway Company will, without competition, build an electric road into the Palouse region, the power for the operation of the line to be furnished by the Washington Water Power Company.

COLIMA, MEX.—A company has been organized for the purpose of acquiring and consolidating the electric lighting and street railway systems of Colima. The company has a capital stock of $120,000. Luis Brizuela, of Colima, is the principal stockholder. It is proposed to convert the street railway system into electric lines and to make important extensions and other improvements.

GUANAJUATO, MEX.—The Dwight Furness Company, of Guanajuato, has placed a party of engineers in the field to locate the route for the electric railway which it will build from Guanajuato to Irapuato, with a branch line to the town of Salamanca, where it will connect with the National Railroad of Mexico. The proposed road will be about 45 miles long. The company was negotiating for the purchase of the property of the Guanajuato Street Railway Company, but on account of failure to agree upon the price to be paid the deal has fallen through.

GUADALAJARA, MEX.—It is announced that the Jalisco Exploitation Company, which was recently organized with a capital stock of $6,000,000 gold, with headquarters at Guadalajara, will build an electric railway from Guadalajara to the port of Chamela, on the Pacific coast. The officers of the company are: President, M. C. Miller, of Guadalajara; vice-president, L. C. Harnecker, of the City of Mexico; general manager, C. W. Whittemore, of the City of Mexico; George Welsh and D. B. Russel, of Guadalajara. It is stated that the electric power plant for the proposed road will be located on the Soledad ranch, 24 miles from Guadalajara, where there is an abundance of water power.

HAMILTON, ONT.—The Hamilton Cataract Power, Light & Traction Company has decided to extend its lines to Oakville.

TORONTO, ONT.—It is said that the Toronto & Niagara Power Company has under consideration the construction of an electric railway from Toronto to Niagara Falls.

New Industrial Companies.

THE C. C. BOHN ELECTRIC COMPANY, of New York, has been formed.

THE ATLANTIC CITY SUBURBAN ELECTRIC COMPANY has been formed; capital $100,000. Incorporators: Louis Kuechnle, Harry E. Woodman and John C. Reed.

THE HEPBURN TELEPHONE MANUFACTURING COMPANY, of Chicago, has been formed; capital $5000. Incorporators: M. E. Hepburn, Walter L. Davis, M. H. Whitney.

THE CHARLES O. BORNE COMPANY of New York has been incorporated to deal in electric supplies; capital $15,000. Directors: C. O. Borne, J. F. Hughes, H. E. Bailey, Brooklyn.

THE M. F. FLECK COMPANY, of New York, has been formed to manufacture electrical appliances, the capital stock being $500. The directors are Edwin Burhorn, L. A. Phillips and M. F. Fleck, New York.

THE H. F. REYNOLDS ELECTRIC COMPANY, of Marion, Ind., has incorporated with a capital of $20,000. The company will manufacture and sell electrical vehicles and equipments for electrical machinery. H. F. Reynolds is president and B. F. Burk, secretary.

THE MACPHERSON-WILLARD COMPANY, of Camden, N. J., has been incorporated with a capital stock of $75,000 to conduct the business of mechanical and electrical engineers. The incorporators are Frederick Shaffer, Philip L. Swank and Wilfred B. Wolcott.

THE BUFFALO POLE-LINE CONSTRUCTION COMPANY, of Buffalo, N. Y., has been incorporated with a capital stock of $10,000 for the purpose of manufacturing electric and telephone materials. The incorporators are W. E. Robertson, C. S. Saunders and A. G. Greenburg, Buffalo.

THE DINKINS ELECTRIC COMPANY, of Indianapolis, Ind., has been incorporated with a capital of $10,000. The company will manufacture and sell engines, motors, electrical apparatus and appliances, telephones, etc. Z. E. Dongan, Henry Hadley, J. H. Hall and John M. Dinkins are the directors.

THE McCAFFREY WATER MOTOR AND POWER COMPANY, of Troy, has been incorporated with the Secretary of State to manufacture, use and transmit electricity; capital stock is $500,000. The sum of $250,000 is to be 6 per cent. preferred stock. The directors are Francis T. Schmidt and Louis C. McBride, of Detroit, Mich., and Joseph G. McCaffrey, Ives Lynd, John E. Hoag, Joseph G. Fenster and Robert F. McCaffrey, of Troy. Operations are to be carried on especially in the towns of Poestenkill, North Greenbush and the cities of Troy and Rensselaer, Rensselaer County, and the towns of Colonie and Green Island and the cities of Watervliet and Albany, Albany County.

Legal.

THE CONSOLIDATED TELEGRAPH & ELECTRIC SUBWAYS COMPANY has asked for an extension of the time in which it was required to file its answer to the suit brought by the city and the extension has been accordingly granted. The suit concerns the monopoly enjoyed in the lighting business by the Consolidated Gas Company through its control of the Consolidated Telegraph & Electrical Subways Company in whose ducts and conduits all electric wires

must be laid. The bill of complaint alleges that the provisions of the contract have been ignored by the company in some highly important particulars and charges that the statements made to the comptroller under the terms of the contract were made in bad faith.

Obituary.

MR. WILLIAM F. POTTER, president of the Long Island Railroad, died at his apartment in the Hotel Marie Antoinette, New York, on Sunday April 20. Mr. Potter had been ill since March 3, when he was prostrated by a severe cold. He was born in Utica, N. Y., in 1846, and received his early railroad training in the West. In 1892, he became general superintendent of the Long Island, and on January 13, 1905, was appointed president to succeed Mr. W. H. Baldwin, deceased, under whom plans for the electrification of the road were all worked out.

MR. W. O. MUNDY.—Mr. William Offutt Mundy died at the East End Hospital, Pittsburg, Pa., March 29, of blood poisoning, developed from an affliction of the ear. Mr. Mundy was a graduate of Ross Polytechnic Institute, Terre Haute, Ind., and was not yet 30 years of age. He was, until a year ago, master mechanic of the St. Louis Traction Company, resigning that position to accept one with the Westinghouse Electric & Manufacturing Company as a commercial engineer at East Pittsburg. He was a man of great energy, and his genial disposition won for him a host of friends. Mr. Mundy was married last January, and his wife survives him.

Educational.

PURDUE LECTURES.—Dr. F. A. C. Perrine lectured during March before the students of Purdue University, Lafayette, Ind., on "Long Distance Power Transmission." Other lectures during the month were "Power Plants," by Prof. J. D. Hoffman, and "Steam and Electric Locomotion," by Prof. H. T. Plumb.

Personal.

MR. W. W. HANEY, formerly with the New York Edison Company, has accepted a position in the engineering offices of Mr. Henry Floy, New York City.

MR. A. L. ROGERS, formerly with the Stirling Company, has joined the Platt Iron Works Company, of Dayton, Ohio, with offices at 93 Liberty Street, New York.

MR. T. C. MARTIN, editor of *Electrical World and Engineer*, who went to Europe last month, expects to sail for home April 12 and arrive in New York on April 19.

MR. RALPH D. MERSHON has removed his New York office to the Hanover Bank Building, 11 Pine Street. His Montreal office remains as before in the Street Railway Chambers.

MR. O. E. GOLDSCHMIDT, lately engineer in charge of steam work for the Fuller Construction Company, has joined the staff of Mr. Henry Floy, consulting engineer, New York City.

MR. W. J. CLARK has been elected president of the Perforated Music Roll Company. This connection will not in any way alter Mr. Clark's present relations with the General Electric Company.

MR. HENRY W. FISHER will deliver a lecture April 6 before the Academy of Science and Art, of Pittsburg, on the production of diamonds by artificial means. The lecture will be accompanied by experimental demonstrations.

MR. WM. MARCONI and his bride arrived in New York on the Cunard steamer *Campania*, March 31. He expects to remain in New York about a week, then go to Glace Bay to put the finishing touches on the trans-Atlantic wireless apparatus which is now being installed there.

MR. P. T. ACKERSON, who has been general sales manager of the American Transformer Company, Newark, N. J., has withdrawn entirely from the electrical field to engage in real estate work. He joins other members of his family in the T. B. Ackerson Company, of 140 Nassau Street.

MR. W. A. STADELMAN, for ten years General Eastern agent of the Brown Hoisting Machinery Company, has been appointed general eastern agent of the Wellman-Seaver-Morgan Company, of Cleveland, Ohio, with offices at 42 Broadway, New York City. Mr. Stadelman assumed the active duties of his new business on April 1.

MR. HENRY D. JACKSON, formerly of the Boston Elevated Railway, and at present lecturer on "Electric Railways" at the Massachusetts Institute of Technology, is devoting himself to consulting work concerning rail bonding, feeder work and electrolysis. Mr. Jackson has had much experience in these branches, which he has made a specialty.

MR. H. D. CRITCHFIELD, general counsel and sales manager for the Automatic Electric Company, Chicago, returned to his desk March 28 after a long and serious seige of illness. Mr. Critchfield was attacked by appendicitis in January and was operated on at the Chicago Hospital, February 1. While convalescing he was seized with pneumonia, from which he has just recovered.

MR. A. C. BUNKER has joined the alternating-current engineering staff of the Crocker-Wheeler Company. Mr. Bunker formerly represented the Stanley Electric Mfg. Company on the Pacific Coast, and recently has been connected with the John F. Kelly Engineering Company. At the St. Louis International Electrical Congress Mr. Bunker, in collaboration with Mr. John F. Kelly, presented a paper entitled "Some Difficulties of High-Tension Transmission and Methods of Mitigating Them."

MR. ISAAC POST, who has been with the firm of Stanley & Patterson for some years, has resigned that connection to accept a position with the Clifton Mfg. Company, of Boston, as sales manager of its New York office. Mr. Post began his connection with the electrical supply field as a boy with the E. S. Greeley Company, and has been constantly engaged in that line of business ever since. As one of the best known electrical supply men in the United States, Mr. Post is particularly qualified for his new duties.

News of the Trade.

THE H. W. JOHNS-MANVILLE COMPANY has established a branch office at 127 New Montgomery Street, San Francisco, Cal.

ALBERT AND J. M. ANDERSON have opened an office in the Farmers' Bank Building, Pittsburg, in charge of Mr. A. E. Meixell.

THE NATIONAL ELECTRIC COMPANY, Milwaukee, Wis., manufacturers of the Christensen air brake and electrical machinery, is now occupying additional offices in the Old Colony Building, Chicago, and has moved the general sales office of the electrical department from Milwaukee to Chicago.

THE STROMBERG-CARLSON TEL. MFG. COMPANY, Rochester, N. Y., reports having closed contracts for switchboards for the following places: McDonough, Ga.; Atwood, Kan.; Orleans, Neb.; Ivesdale, Ill.; Quinter, Kan.; Hendler, Neb.; Waynesville, N. C.; Herald, Ill.; Hayes, Ia., and Arcadia, Fla.

REMOVAL.—The C. & C. Electric Company announces the removal of the Philadelphia offices, April 1, to larger quarters in the West End Trust Building, Broad and Market Streets. This move became necessary through the increase in business due to the development of the company's new line of machines.

ATTACHMENT PLUGS.—The H. T. Paiste Company, Philadelphia, has ready a new line of "P. K." attachment plugs, which includes a new style of the well-known brass-cap type, with a cap to take standard lamp-cord. The full line now includes brass-cap for standard lamp-cord, brass-cap for re-inforced lamp-cord and porcelain.

QUICK TELEPHONE SERVICE RESTORATION.—Fire recently completely destroyed the central office of the Stanford Telephone Company. Sufficient cable was secured for changing the heavy leads to the new location for the central office and an "International" self-restoring drop switchboard and complete central office apparatus was installed and the exchange put in operation in three days.

THE INTERNATIONAL TELEPHONE MFG. COMPANY, of Chicago, is having a heavy demand for its telephones equipped with its long distance transmitter containing its special hard polished granular carbon made by a new process from a special hard coal. It is said that the company's new carbon gives a transmitter of much louder and clearer tone, and it is not susceptible to "frying" or "packing."

THE WELLMAN-SEAVER-MORGAN COMPANY, with main office and works at Cleveland, Ohio, announces that Mr. Geo. B. Damon, who has been manager of its New York office, has been transferred to an important position in connection with the engineering and sales department at Cleveland, Ohio, and that Mr. W. A. Stadelman, for the past ten years manager of the Eastern office of the Brown Hoisting Machinery Company, has become the manager of the general Eastern office of the Wellman-Seaver-Morgan Company, with offices at No. 42 Broadway, New York City.

WESTINGHOUSE MOTORS.—The Alliance Machine Company and the Morgan Engineering Company, both of Alliance, Ohio, have placed orders with the Westinghouse Electric & Mfg. Company, for a total of 120 crane motors with an aggregate of 2000-horse-power. They vary in size from 1 to 100 horse-power. The Pennsylvania Railroad Company on the same day contracted for 20 induction motors to be added to its present motor equipment, and the Bethlehem Steel Company entered an order for direct-current motors to be used in their mills. Numerous smaller orders would make up a list of applications which would cover the whole field of motor-driven machines.

DODGE & DAY, engineers, Philadelphia, Pa., who were commissioned some time since by the Lehigh Coal & Navigation Company to take charge of its extensive shop improvements at Lansford, Pa., including new buildings, machine tools and electrical equipment—in fact all details in connection with such a layout—have been further commissioned to take charge of the erection of a new centrally-located power plant. This plant will provide current for the shops, Tamaqua & Lansford Street Railway, and electrical equipment which will be installed in the mines for pumping and transportation purposes. Dodge & Day are now investigating the latter subject, and specifications will shortly be sent out by them. Mr. Herbert Clarke, engineer for the Tamaqua & Lansford Street Railway, will co-operate with them.

FIRE-PROOF INSULATED WIRE.—The Teter-Heany Developing Company, of York, Pa., is now putting on the market its fireproof insulated wire in sizes smaller than No. 18 B. & S. gauge. This wire is very well suited for use in solenoid coils and small motors for driving machine tools, fans, coffee mills, etc. The insulation cannot be destroyed by being burned out, as it is of such a nature that a coil of wire covered with it can be brought to a red heat without injury to it. Small motors are subjected to rough usage in machine shops and elsewhere, which makes them liable to be burned out. Sudden starts and stops, or overloads, however, are without damaging effects to this form of insulation. The special value of the insulation lies in the thinness of the dielectric (as it can be made as thin as double cotton), its flexibility and strength.

DRYING APPARATUS.—A somewhat novel drying apparatus was recently furnished the Bureau of Engraving and Printing, at Washington, D. C., by the B. F. Sturtevant Co., of Boston, Mass. This apparatus, as specified, consisted of a fan capable of handling 3000 cubic feet of air per minute, and a special form of heater designed to heat at a minimum 2000 cubic feet of air per minute from 32 degrees to 200 degrees F., or a proportionately larger amount from a higher natural temperature. It was specified that the coils should be so completely enclosed with ample thicknesses of asbestos and

so thoroughly insulated as not to transmit heat to the room in which they were placed. These somewhat difficult conditions appear to have been met with success.

WESTINGHOUSE STEAM TURBINE AND GENERATOR OUTFITS.—Among recent orders received by the Westinghouse companies for steam turbines and turbo-generators is one for three outfits for the Public Service Corporation of New Jersey, one having an output of 500-kw and two with ratings of 1000-k.w. each. A 1000-k.w. turbo-generator is building for the Indian Orchard Company, and a 400-h.p. induction motor with starting device, and two 300-k.w. transformers. Westinghouse, Church, Kerr & Company are the designers and engineers for this station. The Truckee River General Electric Company, a large power distributing company of California, operating many high-potential lines, will add a 2000-k.w. alternating current, belt-driven generator, four 750-k.w. and four 625-k.w. transformers to its present equipment. Westinghouse low equivalent lightning arresters and choke coils are being used for the protection of apparatus, and more will be added.

CROCKER-WHEELER WORKS BENEFICIAL ASSOCIATION.—The shop employees of the Crocker-Wheeler Company, at Ampere, N. J., have organized a beneficial association which has a number of novel features. Every employee who pays 10 cents a week to the association will be entitled to $10 a week, for twenty weeks, during incapacity through illness. If he dies, his family will receive $100. The payment of 20, 30 or 40 cents a week entitles him to $15, $20 or $25 respectively, with death benefits of $150, $200 or $250. The plan will go into effect April 3. The company has offered to contribute an amount equal to the dues paid to the association. Thus if $6,000 are paid yearly in dues, the income of the association will be $12,000. The company does not require representation in the association, which will be run entirely by the employees. The president of the association is James Moore, who has charge of one of the big planers in the main bay of the shops. The other officers are Chas. H. Brittain, vice-president; Geo. T. Owen, financial secretary; Frederick Maines, recording secretary, and Wm. Lennox, treasurer.

THE AUTOMATIC ELECTRIC COMPANY, Chicago, has recently closed contracts with the Hastings Independent Telephone Company, Hastings, Neb.; the South Bend Home Telephone Company, South Bend, Ind., and the Wausau Telephone Company, Wausau, Wis., for automatic telephone systems in their respective cities. The automatic switchboard in the Hastings plant will be equipped immediately for 600 subscribers, and will have ultimately a capacity for 5000 subscribers. In addition to the switchboard the Automatic Company will put in a complete central office equipment. Two charging machines will be installed; one will be a motor-generaor to operate on the commercial power circuit and the other will consist of a gasoline engine connected direct to a small direct-current generator, so that the plant will be entirely independent of any outside source of power. The cross connecting frame will be F. B. Cook's latest model with self-soldering heat coils. The South Bend plant will start out with an automatic equipment for 500 subscribers, with an ultimate capacity of 10,000, which will be put in the present central office. The Automatic Electric Company will install this in such a manner that the present manual board and automatic board will be multipled together so that it will make it possible for any one who has an automatic telephone to call any one in the plant automatically, and any one who has a manual phone will be able to call any one in the plant manually. At Wausau, the Automatic Electric Company will install a board with an ultimate capacity of 5000 lines and an immediate equipment of 700. In addition to the board it will furnish the entire central office equipment. The power plant will consist of duplicate storage batteries. The main distributing frame will be F. B. Cook's make, equipped with self-soldering heat coils. The manual switchboard at Wausau is to be cut out of service entirely when the automatic equipment is installed.

Trade Publications.

DODGE & DAY, Philadelphia, in Bulletin No. 175, entitled "A Modern Industrial Plant," describe their work in modernizing the plant of the Jeanesville Iron Works Company, Hazleton, Pa.

WATER TUBE BOILERS.—The Henry Vogt Machine Co., Louisville, has issued a catalogue describing and illustrating in full detail the Vogt Water tube boiler, for which a number of claims of superiority is made.

GARVIN TOOLS.—The latest publications of the Garvin Machine Company are two booklets, one having for its principal subject milling machines, and the other a new type of solid extended milling machine knee.

THREADING AND TAPPING MACHINERY.—The Reliance Machine & Tool Company, Cleveland, Ohio, illustrates in its latest catalogue a line of electrically-driven bolt-cutters. Those shown are for 1½, 2, 2½ and 3-inch bolts.

THE AMERICAN ELECTRICAL SUPPLY COMPANY, Chicago, has secured the sole selling agency for the Newgard receptacle, and has just furnished a new bulletin on the same, which it will be glad to mail upon application.

DEAN TELEPHONES.—The Dean Electric Company, Elyria, Ohio, has issued a folder describing its "Compact" type of telephone stations. Circuits are shown for wiring in series, for bridging, ringing through, non-interfering, divided circuit, selective circuit and central checking.

QUEEN & COMPANY PUBLICATIONS.—The latest additions to the trade publications of Queen & Company, Philadelphia, are three circulars describing respectively Queen stand-pipe rheostats, Queen X-ray negatives, X-ray illuminators, and the Beauregard wattmeter error calculator.

LOMBARD GOVERNORS.—Bulletin No. 103 of the Lombard Governor Company is devoted to a description of its type "N" machine, which is an entirely new form of hydraulic governor. The capacity of this governor is much greater than that of any standard governor heretofore manufactured.

NORTHERN MOTOR PLANER DRIVES.—The Northern Electrical Mfg. Company, Madison, Wis., has reprinted in pamphlet form for distribution two articles contributed by Mr. J. C. Steen to the *American Engineer* and *Railroad Journal*, entitled, "A Test of a Motor-Driven Planer," and "Cutting Test on a Metal Planer."

ELECTRIC BENCH GRINDERS.—In Booklet No. 42 the Northern Electrical Mfg. Company, Madison, Wis., illustrates and describes the "Northern" electric bench grinder, a machine which has been designed with careful attention to every detail of the requirements of special work. The driving motor is rated at ½ hp. and carries two ¼-in. emery wheels, 6 inches in diameter.

STORAGE BATTERY INSTRUCTION BOOK.—The Electric Storage Battery Company has issued a useful pamphlet entitled "The Exide Battery Instruction Book," containing instructions for the care of the Exide battery in electric vehicles. The instructions treat in detail every point from unpacking and assembling, through operation, to putting out of commission and disconnecting.

THE CENTRAL ELECTRIC COMPANY, Chicago, in a recent folder, describes the C. E. "Universal" portable and desk lamp. The term "Universal" is well deserved, for the lamp can be used for the roll-top desk, the stenographer's desk or as a bracket, in each case admitting of the adjustment of the source of light so as to throw the illumination exactly where it is wanted.

WATERTOWN ENGINES.—The latest catalogue of the Watertown Engine Company is beautifully illustrated with Bartlett half-tones and printed on the new special paper which gives all the effect of the expensive photogravure. All of the various types of engines made by the company are illustrated and described, and the half-tone engravings bring out the details almost as clearly as line cuts.

ELECTRICAL CATECHISM.—The National Electric Company, Milwaukee, U. S. A., is distributing in serial form an electrical catechism giving in the form of questions and answers information concerning the technical applications of direct and alternating current. The first number of the series explains some of the fundamental principles of electricity by means of hydraulic analogies, and the second number relates to electrical units and their determination.

HUNT NOISELESS CONVEYER.—Catalogue No. 53 of the C. W. Hunt Company, New York, is a large octavo pamphlet of 52 pages and contains more than 150 illustrations. The Hunt noiseless conveyer in its various forms is described and illustrated in every detail, and then more than 100 illustrations are given of installations of this apparatus. As many of the illustrations are in line giving engineering details, this pamphlet will be found of unusual value by engineers interested in this kind of work.

STEAM AND OIL SEPARATORS.—The Crane Company, Chicago, has issued "advance circular No. 01" of Crane steam and oil separators, describing Crane steam and oil separators for the separation of water from live steam and the elimination of oil from exhaust steam. This apparatus is made in sizes from 1 to 30 inches in horizontal, vertical, angle and distributing types. The circular contains 26 10½x13½ sheets, printed on white enameled paper and handsomely illustrated with half-tone engravings.

WEBER ELECTRIC WIRING SPECIALTIES.—Mr. Henry D. Sears, 131 State Street, Boston, has issued a catalogue illustrating and describing the various Weber electric wiring specialties. These consist of fuse, fuseless and cleat rosettes, ceiling buttons, Edison cutouts, porcelain cleats, wiring knobs and insulators and porcelain receptacles and socket rings. A supplement to the catalogue describes and illustrates the Weber key socket, one of the features of which is that no screws or rivets are used to hold the shell and cap together.

RAPID CONSTRUCTION.—With this title, Frank B. Gilbreth, general contractor, with offices in Boston, New York and Baltimore, has issued a pamphlet giving progress views of prominent buildings which he has erected in marvelously short periods of time. As an example, one view shows the site of the Augustus Lowell Laboratory of the Massachusetts Institute of Technology on July 13, and other views taken at intervals of about two weeks, with the finished building shown as it appeared three months after the foundations were commenced.

INCANDESCENT LAMP STANDARDS.—The Electrical Testing Laboratories, 546 East 80th St., New York, have recently issued an interesting pamphlet devoted to the subject of electric incandescent lamps used as standards of candle-power. This publication covers methods of preparation and the proper use of standard lamps, a description of its special type of lamp constructed for photometric work, and a descrition of a portable high accuracy potentiometer which may be used in connection with seasoned and standardized incandescent lamps for the accurate checking of direct-current ammeters. The company is also distributing, in pamphlet form, a description of the equipment and facilities of its plant.

THE WARD LEONARD ELECTRIC COMPANY, Bronxville, N. Y., devotes catalogue No. 19,054 to Ward Leonard enamelled field rheostats. This company states that it is the sole licensee under ten patents belonging to H. Ward Leonard covering all the principal forms of field rheostats. During the past twelve years it has repeatedly and voluntarily made large reductions in price as the various improvements have been made which have enabled it to make reduction in the cost of production. This catalogue shows new and extremely low prices. It also shows new features of design, "one piece" buttons being used as stationary contacts and self aligning renewable skate shoes as movable contacts. It is stated that with the company's new method a front-of-board rheostat can be changed to a back-of-board rheostat in less than ten seconds. It is only necessary to remove the wooden hand wheel and insert the back-of-board shaft.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 25, 1905.

[Conducted by Rosenbaum & Stockbridge, Patent Atty's, 140 Nassau St., N. Y.]

785,700. ELECTRIC CONDUCTOR SUPPORT; Johan M. Anderson, Boston, Mass. App. filed Jan. 5, 1905. Relates to an electric conductor support, which may be used in connection with a section-line insulator in overhead electrical railway systems, so that the piece or bridge of insulating material which supports the line terminals may be secured in such a manner as to permit said bridge to be readily removed from the line terminal.

785,712. ELECTRIC CABLE JOINT; Donald J. Chisholm, East Hampton, N. Y. App. filed May 11, 1904. Comprises a box for surrounding the cable ends at their joint in connection with a readily removable cover permitting access to the joints when desired.

785,728. TELEPHONE SYSTEM; Adolph C. Gilgen, Passaic, N. J. App. filed June 11, 1904.

785,731. MEANS FOR CONVERTING ELECTRICAL CURRENTS FOR INDUCTION MOTORS; Christian F. Heinkel, Cleveland, Ohio. App. filed Aug. 4, 1904. The primary circuit of the induction coil has a make and break device, the secondary circuit connects with the terminals of the induction motor, which has a cam for positively operating the make and break device, whereby the motor will positively control the induction coil. One of the claims being: "A transformer and a source of current therefor, a circuit breaker for said transformer, a motor electrically connected with said transformer, and synchronizing mechanism for said motor and transformer."

785,754. TELEPHONE EXCHANGE APPARATUS; James L. McQuarrie, Chicago, Ill. App. filed May 27, 1901.

785,758. ELECTRIC RAILWAY SYSTEM AND CONDUIT; George W. Olinger, Orchard, Ohio. App. filed June 19, 1903. Comprises a girder rail having a tread surface at the top, one side of its overhanging head forming the top of a conduit, the vertical web forming one side of the conduit, and a second longitudinal member or beam secured to said rail and comprising a horizontal portion forming the bottom of the conduit, and a vertical portion forming the other side wall of the conduit, said vertical portion extending upward to a level with the top of the rail and being separated therefrom to form a slot or opening.

785,797. THERMAL CUT-OUT FOR ELECTRICAL CIRCUITS; Frank B. Cook, Chicago, Ill. App. filed March 9, 1904.

785,798. SELF-SOLDERING HEAT-COIL; Frank B. Cook, Chicago, Ill. App. filed March 9, 1904.

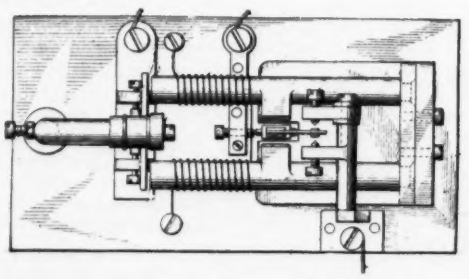
785,803. ART OF TRANSMITTING INTELLIGENCE; Cornelius D. Ehret, Philadelphia, Pa. App. filed Feb. 10, 1902.

785,804. SYSTEM OF TRANSMITTING INTELLIGENCE; Cornelius D. Ehret, Rosemont, Pa. App. filed Feb. 10, 1902.

785,873. CHAIN; Rutherford G. Goldman, Los Angeles, Cal. App. filed May 2, 1904. Relates to an improvement in chains adapted to be wired with electrical conductors so that the wires are completely concealed, the links of the chain permitting the ready wiring of the same, and the claims among other things calling for "A conduit for electric wires, comprising a seres of hollow links, each link passing through and communicating with the adjacent links."

785,891. RAILWAY BLOCK SIGNAL APPARATUS; Allen B. Kendall, Maywood, Ill. App. filed Oct. 17, 1904. The block railway signal system has a normally stationary contact and a movable contact. When these contacts adhere together or become welded or fused from disturbances from electrical storms or cross wires, and have a tendency to move together, the circuit will be broken by the normally stationary contact breaking with a mercury connection; the making and breaking continuing as before.

785,731.—Means for Converting Electrical Currents for Induction Motors.



785,941.—Compound Relay.

785,909. ELECTRIC RAILWAY SYSTEM; John C. McDonald, New York, N. Y. App. filed Feb. 9, 1904. Details in a switch to permit the current to flow into a short length of the contact rail.

785,926. FRICTION CLUTCH; Harry A. Williams, Akron, O. App. filed May 12, 1904. Electrically-operated friction clutch whereby the clutch may be gradually applied, instantly released and a brake applied. And whereby an electrical signal may be given when the parts are not working properly.

785,941. COMPOUND RELAY; Stephen D. Field, Stockbridge, Mass. App. filed Jan. 14, 1905. Consists of a receiving instrument or relay having two independently movable armatures, one of which responds to changes in polarity without regard to current strength, while the other responds to changes in current strength without regard to polarity. Each armature controls a separate and independent local circuit. This apparatus is intended for use in duplex or quadruplex telegraphy where two messags are sent in the same direction at the same time and consists, first, in a single relay having two armatures which co-operate beneficially in their influence upon the core or cores as distinguished from the distributing reaction incident to the use of similar apparatus now in use; second, in a polarized relay having two magnetic circuits and two armatures employed in connection with a single main-line coil, whereby the coil resistance is reduced or minimized. The neutral armature may be used to record variations in current strength, while the polar armature is more sensitive to reversals and less sensitive to minor variations.

785,949. DOUBLE THROW ELECTRIC SWITCH WITH INDICATOR; Edward M. Hewlett, Schenectady, N. Y. App. filed July 11, 1903. A visual signal is connected with a double-throw switch, so that the operator may know in which direction the switch is to be moved at its next actuation.

785,970. MEANS FOR REGULATING ELECTRIC CIRCUITS; Walter S. Moody, Schenectady, N. Y. App. filed July 26, 1902. (See Current News and Notes).

785,980. ELECTRIC ARC LAMP; Ralph Scott, Wilkesbarre, Pa. App. filed Oct. 14, 1903. Embodies means for controlling the space of the arc.

785,985. SWITCH; Samuel B. Stewart, Jr., Schenectady, N. Y. App. filed July 15, 1903. Comprises a contact carrier provided with brushes, a bridging contact, two contact blocks and two contacts in shunt around the blocks, together with means for actuating the operating handle and for holding the same under elastic pressure.

785,994. RHEOSTAT FOR STARTING AND CONTROLLING ELECTRIC MOTORS; William C. Yates, Schenectady, N. Y. App. filed Sept. 14, 1904. While using the same size of resistance conductor and contacts, the total dimension of the device is reduced, one-half of the row of stationary contacts are arranged parallel with the other half, and two contact arms are so arranged that as one arm is moved in one direction, it engages its respective row of contacts to start the motor, and after traveling half the distance traveled by the ordinary rheostat arm, it picks up the other arm, so that by return movement of the first arm, the second is drawn forward, cutting out the resistance sections by which the power developed by the motor is regulated.

785,995. WINDING FOR THREE-PHASE MOTORS; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Aug. 19, 1904.

785,997. INCANDESCENT ELECTRIC LAMP SOCKET; George C. Baillard, Brooklyn, N. Y. App. filed May 28, 1902. The socket has a closure which upon rotation will cover the bared ends of the wires between their insulation and the point where they enter the socket.

786,005. ELECTRIC PROTECTOR APPARATUS; Frank B. Cook, Chicago, Ill. App. filed April 11, 1904.

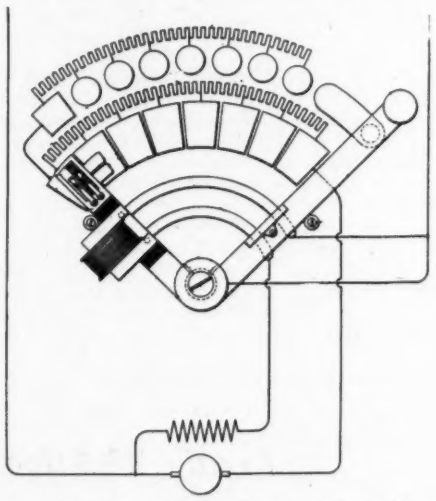
786,008. AIR BRAKE CONTROL; Fred B. Corey, Schenectady, N. Y. App. filed Aug. 13, 1904. This control permits two pressures in the air-brake cylinder to be selected by the motorman at will. When running in rural sections at a high speed, greater pressure may be employed upon the brakes than when running at the lower speed within the city.

786,010. COMMUTATING DEVICE FOR ARMATURES OF ALTERNATING-CURRENT MACHINES; Max Deri, Vienna, Austria-Hungary. App. filed March 31, 1903. (See Current News and Notes.)

786,016. COMBINED ELECTRIC AND MECHANICAL SIGNAL APPARATUS FOR ELEVATORS; William T. Dulany, Jr., Brooklyn, N. Y. App. filed May 11, 1904. Details of construction.

786,017. STARTING RHEOSTAT; Edgar F. Dutton, Schenectady, N. Y. App. filed Nov. 13, 1902. Embodies, among other things, the employment of a device at or near the off-position of the rheostat brush which controls the closure of the motor circuit and to which the brush must be shifted before the circuit can be closed at all.

786,024. SYSTEM OF DISTANT ELECTRICAL CONTROL; Joel Gomborrow, Lynn, Mass. App. filed Sept. 15, 1904. Relates to means for controlling the motion of an object within fixed limits so that it can be stopped at any point in its travel and be started in either direction from any such point, together with means for indicating at the controlling station the movement of such object.



785,994.—Rheostat for Starting and Controlling Electric Motors.

786,036. TROLLEY WHEEL AND HOLDER; Henry N. King, Adrian, Mich. App. filed June 20, 1904. Construction of the trolley wheel embodying, among other things, a hard metal tire at the bottom of the groove in the wheel.

786,041. VIBRATOR FOR SOUND TELEGRAPH APPARATUS; Arvid A. Lind, Stockholm, Sweden. App. filed June 17, 1903. The induction coil has a hollow iron core connected with the armature to form the key of the telegraph device.

786,132. WIRELESS TELEGRAPHY; Guglielmo Marconi, London, England. App. filed Oct. 13, 1903. (See Current News and Notes.)

786,146. ELECTRIC HAMMER; Louis Paulero, Petersburg, Va. App. filed Sept. 22, 1904. Embodies means for adjusting the throw of the plunger and comprising an adjusting plunger controllable at will.

786,148. SIGNAL SYSTEM FOR ELECTRIC RAILWAYS; Greenleaf Whittier Piskard, Amesbury, and Harold J. W. Fay, Westboro, Mass. App. filed Jan. 28, 1905.

786,188. TROLLEY; James L. Brownlee, Pittsburg, Pa. App. filed June 10, 1904. A pair of spindles are provided having rotatable contacting knobs grooved for receiving the wire with upwardly tapering terminals for guiding the wire between the knobs, together with details for lubrication.

786,209. ELECTRIC RAILWAY SIGNALING SYSTEM; John D. Gordon, Riverside, Cal. App. filed May 5, 1904. Embodies constantly charged conductors, an electrical generator on the train and open circuit conductors for the blocks.

786,216. WIRE STRINGER; Walter H. Horner, Seattle, Wash. App. filed Jan. 15, 1904. This stringer is intended for use in conduits and has means for stopping the motor which it carries when the tension becomes too great upon the wire which is being strung.

786,219. TROLLEY; Sando Kacso, Allegheny, Pa. App. filed Dec. 9, 1904. The harp has horns overhanging the trolley wheel for engaging the wire should it jump from the wheel.

786,231. ELECTRIC LAMP; George P. McDonnell, St. Louis, Mo. App. filed Jan. 5, 1905. The material composing the teat at the end of the lamp bulb is partially located within the lamp or bulb, reducing its protuberance upon the outside.